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ABSTRACT

This instructional guide, one product of a large-scale research project on Jaime Escalante and his Mathematics and Science Program, describes the teaching and motivating strategies that he uses to bring about high academic achievement among poor minority urban youth in Los Angeles (California). The first part of five describes a pilot test in which a colleague and an administrator who have worked with and observed Escalante rated a list of successful techniques according to the degree to which they explained Escalante's teaching success. Part 2 describes the responses of senior high school students who had been Escalante's students for 3 or 4 years to a similar questionnaire. Part 3 shows the results of a similar rating process by several of Escalante's colleagues, which found a 74 percent level of agreement between students and colleagues. Part 4, the longest section, contains the taped transcription of an interview with Escalante designed to determine whether or not he agreed with his students' ratings of his teaching techniques and to ask whether his students had left out anything. Part 5 discusses the study's findings. Extensive appendixes contain information on the Jaime Escalante Mathematics and Science Program, questions from the pilot test, questions from the other phases of the study, student responses, abstracts of the paper, correspondence, and the study contract. Contains 29 references. (JB)

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AN INSTRUCTIONAL GUIDE
Concerning the Highly Successful
Teaching & Motivating Practices of Jaime Escalante

for The Escalante Math Project
at East Los Angeles College

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An Instructional Guide Concerning the Highly Successful Teaching and Motivating Practices of Jaime Escalante

Prepared for

The National Science Foundation
Washington, D.C.

The ARCO Foundation
Los Angeles, California

The Ford Motor Company and Foundation
Dearborn, Michigan

and

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The Preface and Parts 1 and 2 of this paper were presented at the annual conference of the American Evaluation Association (AEA) held in Washington, D.C. in November 1990 and at the California Educational Research Association (CERA) Conference held in San Diego in November 1990. The remainder of this paper was presented at the Annual Conference of the American Evaluation Association held in Seattle, Washington in November 1992 and at the California Educational Research Association (CERA) Conference in San Francisco in November 1992.

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PREFACE

Introduction, Overview, and Acknowledgments

Introduction

In November 1988 East Los Angeles College (ELAC), acting on behalf of a private sector partnership, submitted a grant application to the National Science Foundation (NSF). The proposed three year project was entitled, "The Jaime Escalante Mathematics and Science Program." According to the abstract, the Escalante project would address:

> ". . . the national need to increase the pool of applicants to mathematics based university programs and to increase the number of well-trained mathematics instructors. (Additionally, the project would fund) . . . the expansion of the highly successful East Los Angeles College Advanced Placement Calculus Program to include a second local high school, (and establish) . . . a supporting mathematics program for three feeder junior high schools and their six feeder elementary schools." (ELAC, 1988, NSF Grant Application, p. 3.)

George Madrid of East Los Angeles College was to be the project's principal investigator. As project director, George would be assisted by Paul Powers and Dr. Kevin Galvin, both identified as project counselors. These three constituted the entire non-teaching professional project staff. The project envisioned the training of fifteen teachers by the "nationally acclaimed master teacher, Jaime Escalante." (Ibid.) It was hoped that with the added funding requested, the successes of the East Los Angeles College Advanced Placement Calculus Program could be "multiplied in many directions" to facilitate even greater gains by an even larger group of inner-city minority students. (Ibid.)

Over the more than three year period (1989-1991+) the overall project cost would be approximately $1 million. Of that, East Los Angeles College would contribute approximately 36 percent, the National Science Foundation approximately 37 percent, the ARCO Foundation approximately 15 percent, and the Ford Motor Company approximately 12 percent.

The NSF grant application contained the following language regarding the preparation of a "Program Manual" or "Instructional Guide."

> ". . . an Instructional Guide (Program Manual) will be prepared that documents the body of techniques that make up the teaching and motivating methods of Jaime Escalante. . . The primary contributor of material will be Escalante . . . The product intended primarily for in-house instruction, will have value for the replication of the program in other communities. . . " (ELAC, 1988, p. 21.)

This document is hereby submitted to satisfy the requirement to produce an Instructional Guide.

In addition, you are encouraged to read the article entitled, "The Jaime Escalante Math Program" which first appeared in the Journal of Negro Education, volume 59, number 3 (summer 1990). The authors were Jaime Escalante and Jack Dirmann, associate director of the Foundation for Advancements in Science and Education (FASE). The article was copyrighted in 1990 and later reprinted under separate cover (1990) by the National Education Association (NEA).

In a real sense, the journal article began and ended with Jaime Escalante. In his initial statement in the reprinted article, he wrote:

> "In recent years, I have been deluged with questions from interested teachers, community leaders, and parents about my success in teaching mathematics to poor minority children. I am not a theoretician; my expertise is in the classroom and my first commitment is to my students. Nonetheless, I am willing to share my opinions on this subject in the hope that they might be helpful to other professionals in the field of education. I am hopeful this article will provide answers. I have called upon my colleague, Jack Dirmann. . . . to assist in the preparation of this manuscript." (Escalante and Dirmann, 1990, p. 1.)

Since Mr. Dirmann's role was to assist, it seems clear that the primary contributor to the journal article was Jaime Escalante. As will be seen, Mr. Escalante was the primary contributor to this Instructional Guide as well.

Overview

By way of contrast, this Instructional Guide began elsewhere and ended with Jaime Escalante. It began with questionnaires about research findings related to teaching, learning, motivating, and asking respondents—his colleagues and calculus students—to identify those findings which best explained his successful teaching and motivating practices. It ended with a videotaped interview with Mr. Escalante in which he responded to each relevant research finding identified by his calculus students.

This Instructional Guide has several main parts:

Part 1	~	The Pilot Test
Part 2	~	Questionnaire responses from Mr. Escalante's calculus students.
Part 3	~	Questionnaire responses from Mr. Escalante's colleagues/"key informants."
Part 4	~	An edited transcription of a videotaped interview with Mr. Escalante.
Part 5	~	Discussion

Part 4, which consists of Mr. Escalante's transcribed remarks, is 26 pages long. This is considerably longer than Parts 2 or 3. Since he spoke last and longest, he should be recognized as the primary contributor to this Instructional Guide as well as the journal article. As the reader of Part 4 will notice, Mr. Escalante agreed that he does use the teaching and motivating strategies identified by his calculus students in Part 2 of this Guide. In the Discussion part, one frame of reference will be suggested for summarizing the findings from this study.

It is one thing for an excellent teacher to describe what he believes and what he does; it is something different to begin with an identification of those attitudes and practices of his which have most impressed others. The first approach (the journal article) concentrates on the sender (the teacher), whereas the second (this guide) concentrates on the receivers (the students). While both sides of this transaction are significant in the teaching–learning interaction, it should be remembered that the active participants in this interaction are only two, the teacher and his students; everyone else is either an observer or facilitator.

The approach taken in this guide combines Mr. Escalante's notion that there are "common denominators" in the actions of "very effective teachers," and a procedure in use in program evaluation referred to as "triangulation." First, Mr. Escalante's statement:

> ". . . If we were to study the methods of a hundred very effective teachers, my guess is that we would find their approaches to be rather simple and direct, with many common denominators. . . . I believe we teachers should devote more time identifying and implementing techniques that have withstood the acid test of classroom performance. . . " (Escalante and Dirmann, 1990, p. 6.)

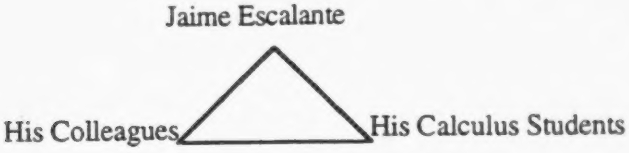
For decades, educational researchers have sought to identify those "common denominators" that have "withstood the acid test of classroom performance." In this Instructional Guide those common denominators are called "research findings," since research is required to identify those practices that have "withstood the acid test of classroom performance." "Research findings" is also the term used in the booklet, What Works: Research About Teaching and Learning.

In his recent book on qualitative evaluation and research methods, Michael Quinn Patton (1990) discussed "triangulation" as follows:

> One important way to strengthen a study design is through triangulation, or the combination of methodologies in the study of the same phenomena or programs. This can mean using several kinds of methods or data, including using both quantitative and qualitative approaches. Denzin (1978b) has identified four basic types of triangulation: 1) data triangulation–the use of a variety of data sources in a study; 2) investigator triangulation–the use of several different researchers or evaluators; 3) theory triangulation–the use of multiple perspectives to interpret a single set of data; and 4) methodological triangulation–the use of multiple methods to study a single problem or program.
>
> The term triangulation is taken from land surveying. Knowing a single landmark only locates you somewhere along a line in a direction from the landmark, whereas with two landmarks you can take bearings in two directions and locate yourself at their intersection (Fielding and Fielding, 1986: 23). The term triangulation also works metaphorically to call to mind the world's strongest geometric shape–the triangle (e.g., the form used to construct geodesic domes á la Buckminster Fuller). . .
>
> Triangulation is ideal. It can also be very expensive. An evaluation's limited budget, short time frame, and political constraints will affect the amount of triangulation that is practical. Certainly, one important strategy for conducting evaluation research is to employ multiple methods, measures, researchers, and perspectives–but to do so reasonably and practically. (Patton, 1990, p. 187)

Since this guide presents information from: 1) Mr. Escalante's colleagues (Part 1, 2) his calculus students (Part 2), and Mr. Escalante himself (Part 3), it presents "multiple perspectives" and uses the first basic type of triangulation listed above, data triangulation. (See Figure 1 below.) Furthermore, since different methods were used to collect information–questionnaires for Parts 1 and 2, and a structured interview for Part 3–this guide also uses multiple methods to obtain information.

Figure 1
Data Source Triangulation



Mr. Escalante's colleagues and his calculus students completed a lengthy questionnaire (see Appendix C). Then, in the videotaped interview, Mr. Escalante responded to the top 38 practices identified by his calculus students as more like him. By either questionnaire or interview, the three sources of information—Jaime, his colleagues, and calculus students—responded to the same items. Three sources responding to the same prompts give us our data triangulation.

The overall approach taken by this Instructional Guide can be described by using a combination of logic and the language of mathematics, including set theory and Venn diagrams. Consider the following:

Goal: To describe the contents of Set A

Where: Set A = {The successful teaching and motivating practices of Mr. Jaime Escalante}

To meet the goal, we first make some assumptions, then we reason logically.

Assumption # 1: Assume you can discover the contents of Set B

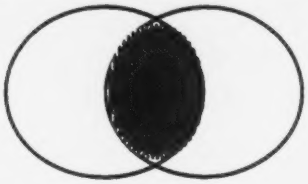
Where: Set B = {The successful teaching and motivating practices identified by prior research studies}

Assumption # 2: Assume there are common teaching and motivating practices–Escalante's "common denominators"–in use by "very effective teachers"–including Jaime Escalante himself.

In the language of mathematics, we now have the "intersection" of Sets A and B ($A \cap B$) as shown in Figure 2:

Figure 2

Intersection of Sets A and B



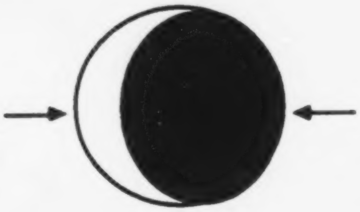
Where:
Set A = {The successful teaching and motivating practices of Mr. Jaime Escalante}

Where:
Set B = {The successful teaching and motivating practices identified by prior research studies}

If Set B is known, and Set B intersects Set A, then by definition, the two sets contain some of the same elements, or practices. Furthermore, part of Set A—the common practices—the shaded area in Figure 2 above—is known. It is known because all of Set B is known. At this point, what is known and unknown is illustrated in Figure 3.

Figure 3

Set A After the Intersection With Set B



These practices—which are unique to Jaime Escalante—are still unknown.

These practices—which were also contained in Set B—are now known, since all of Set B is known.

Where: Set A = {the successful teaching and motivating practices of Mr. Jaime Escalante}

Two major tasks now remain. Fortunately, both can be accomplished by interviewing Mr. Escalante.

Final Tasks:

1. Verify, during an interview with Escalante, whether those practices identified by his calculus students as "common"—the shaded area in Figure 3—are common; that is, they are practices he uses.

2. Identify, during an interview with Escalante, practices unique to him; that is, identify the remainder of Set A.

Acknowledgments

It is clear at once that the multi-year "Jaime Escalante Mathematics Project" could not have existed except for the efforts of this masterful teacher and the financial support provided by the National Science Foundation (NSF), the ARCO Foundation, Ford Motor Company, and East Los Angeles College (ELAC).

Mr. Escalante's success in teaching advanced mathematics to inner-city, mostly Hispanic, students is well known. It has been described not only in a book, Escalante, the Best Teacher in America, but also in a film "Stand and Deliver." His work has been well documented especially in the popular press. The project bears his name because it was built around him. And, since the project cost more than $300,000 a year, outside funding was essential. Appreciation goes to Jaime for his leadership, to the funding agencies for their support, and to the project director and his staff for their able management of the entire project. The project itself was large, comprehensive, and complex. (See Appendix A for more detail on the project and its many components.)

For their personal interest and support of the project many individuals at several agencies need to be thanked. Appreciation goes to the following:

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- Arthur Avila, Former President, East Los Angeles College;
- Ken Hunt, Former Dean of Academic Affairs, East Los Angeles College;
- George Madrid, Director, Escalante Math Project;
- Paul Powers, Counselor, Escalante Math Project;
- Kevin Galvin, Counselor, Escalante Math Project; and
- Maria Cabral, Yoli Alvarez, Marcella Nolasco, and Alice Maldonado—all program assistants to the Escalante Math Project

At the Coca-Cola Corporation and Foundation

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- Rudy Beserra, Senior Staff Representative for Corporate Affairs
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Very special thanks go to George Madrid, Paul Powers, and Kevin Galvin for many enjoyable hours of discussion about teacher effectiveness in general and Jaime and his students in particular.

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Finally, those at the Los Angeles County Office of Education who should be recognized and thanked include: Dr. Fred Smith and Steve Yamarone for doing the statistical analysis; Merlyn Madrigal for transcribing the videotape of the Escalante interview; Laurene Twineham and JoAnne Long for editing the transcription of the Escalante interview; and Merlyn Madrigal, Rachel Hoo, Lori Trent, and Connie Cortez for doing the word processing necessary to produce this Instructional Guide. Administrators who supported this investigation include: Dr. Alice Healy-Sesno, consultant-in-charge, Evaluation, Research, and Support Services; Dr. Nancy Krause, director, Educational Support Services; Dr. Gordon Footman, former director, Educational Support Services; Dr. Gilberto Anzaldua, assistant superintendent, Educational Services; and Dr. Stuart E. Gothold, superintendent.

Part 1
The Pilot Test

Seeking the Answer to the Question "Will This Approach Work?"

This Instructional Guide presents important perspectives on ". . . the body of techniques that make up the teaching and motivating methods of Jaime Escalante." (ELAC, 1988, p. 21.) The approach taken here was to: First, identify Set B, where Set B contained successful teaching and motivating methods identified by prior research studies; second, identify which of those methods were used by Escalante (identify the intersection of Set A and Set B); and finally, identify the remainder of Set A; that is, identify those unique methods that only Escalante uses.

But, would this research oriented approach work? What Escalante does is obviously very successful, since his students are very successful, so there is a Set A that contains the successful practices he uses. Is there also a Set B that contains successful practices identified by prior research? Does Set A intersect Set B? That is, are some practices in Set B also in Set A? Does Escalante agree that he uses the practices on others report he does? Are there additional, unique practices he uses? These are the main questions that had to be answered.

Part 1 reports answers to several of these questions. For purposes of this pilot test, Set B was identified as containing the 59 "Research Findings" (methods or practices) listed in the booklet entitled, What Works: Research About Teaching and Learning. (U.S. Department of Education, 1987.) Two colleagues of Escalante, a math teacher in his department at Garfield High and his assistant principal there were identified as "key informants." Angelo Villavicencio, the math teacher, had sat in Escalante's classes and observed him teach for eight weeks. Angelo proudly states that, "For five years Jaime was my master teacher and mentor." Cathy Lum, the assistant principal, had for a number of years observed Jaime teaching, both formally and informally. As knowledgeable informants, they agreed to read through the list of 59 "Research Findings" and rate each one on the degree to which it explained Escalante's teaching success. More precisely, they were given the following question and response categories for each finding.[1]

---

[1] Key informants were asked several questions. For more detail on these questions, please see Appendix A.

Does this research finding to some extent explain the teaching success of Jaime Escalante?

______ Yes, a great deal
______ Yes, for the most part
______ Somewhat
______ Only a little
______ No, not at all

Ideally, through their rating of each finding, Escalante's colleagues would scatter those findings across a continuum from those that very closely match what he does to those that do not match what he does at all. Fortunately, this is exactly what happened.

Based on ratings by key informants, it was possible to separate the 59 research findings into four groups. For convenience, these groups have been identified as: "The first, second, third, and last tier." The fifteen findings in the first tier were judged to be the best match. Both key informants answered, "Yes, a great deal" when asked the degree to which each of these findings explain Escalante's success. This is shown in Table 1.

Table 1

Key Informant Judgment Calls On The Extent To Which Each of Fifty-Nine Research Findings Explain the Teaching Success of Jaime Escalante

Categories of explanation strength	No. of research findings contained in each category	Where displayed	Actual judgment calls by key informants
The First Tier	15	Table 2	Both key informants answered, "Yes, a great deal."
The Second Tier	9	Table 3	One key informant answered, "Yes, a great deal," and the other answered, "Yes, for the most part."
The Third Tier	7	Table 4	Either both key informants answered, "Yes, for the most part," or one key informant answered, "Yes a great deal" and the other answered, "Somewhat."
The Last Tier	28	Table B-1 In Appendix B	Answers did not exist or included the weaker categories of "Only a little" or "No, not at all."

Note: All research findings were taken from What Works: Research on Teaching and Learning, Second Edition, published by the United States Department of Education, 1987.

Research findings in the first three tiers are shown in the following three tables.

Table 2

The First Tier
The Top Fifteen Research Findings Identified by Key Informants As Explaining The Teaching Success Of Jaime Escalante

---

1. Developing Talent

"Many highly successful individuals have above average but not extraordinary intelligence. Accomplishment in a particular activity is often more dependent upon hard work and self-discipline than on innate ability" (p. 14).

2. Ideals

"Belief in the value of hard work, the importance of personal responsibility, and the importance of education itself contributes to greater success in school" (p. 15).

3. Cooperative Learning

"Students in cooperative learning teams learn to work toward a common goal, help one another learn, gain self-esteem, take more responsibility for their own learning and come to respect and like their classmates" (p. 21).

4. Teacher Expectations

"Teachers who set and communicate high expectations to all their students obtain greater academic performance from those students than teachers who set low expectations" (p. 35).

5. Attaining Competence

"As students acquire knowledge and skill, their thinking and reasoning take on distinct characteristics. Teachers who are alert to these changes can determine how well their students are progressing toward becoming competent thinkers and problem solvers" (p. 38).

6. Managing Classroom Time

"How much time students are actively engaged in learning contributes strongly to their achievement. The amount of time available for learning is determined by the instructional and management skills of the teacher and priorities set by the school administration" (p. 39).

7. Behavior Problems

"Good classroom management is essential for teachers to deal with students who chronically misbehave, but such students also benefit from specific suggestions from teachers on how to cope with their conflicts and frustrations. This also helps them gain insights about their behavior" (p. 40).

8. Direct Instruction

"When teachers explain exactly what students are expected to learn, and demonstrate the steps needed to accomplish a particular academic task students learn more" (p. 41).

9. Study Skills

"The ways in which children study influence strongly how much they learn. Teachers can often help children develop better study skills" (p. 49).

Table 2

The First Tier
The Top Fifteen Research Findings Identified by Key Informants As Explaining The Teaching Success Of Jaime Escalante
(continued)

10. Homework Quantity

"Students achievement rises significantly when teachers regularly assign homework and students conscientiously do it" (p. 51).

11. Homework Quality

"Well-designed homework assignments relate directly to classwork and extend students' learning beyond the classroom. Homework is most useful when teachers carefully prepare the assignment, thoroughly explain it, and give prompt comments and criticism when the work is completed" (p. 53).

12. Prior Knowledge

"When teachers introduce new subject matter, they need to help students grasp its relationship to facts and concepts they have previously learned" (p. 55).

13. Effective Schools

"The most important characteristics of effective schools are strong instructional leadership, a safe and orderly climate, school-wide emphasis on basic skills, high teacher expectations for student achievement, and continuous assessment of pupil progress" (p. 57).

14. Character Education

"Good character is encouraged by surrounding students with good adult examples and by building upon natural occasions for learning and practicing good character. Skillful educators know how to organize their schools, classrooms, and lessons to foster such examples" (p. 59).

15. Rigorous Courses

"The stronger the emphasis on academic courses, the more advanced the subject matter, and the more rigorous the textbooks, the more high school students learn. Subjects that are learned mainly in school rather than at home, such as science and math, are most influenced by the number and kind of courses taken" (p. 75).

Note: All research findings were taken from What Works, Research on Teaching and Learning, Second Edition, published by the United States Department of Education, 1987. Page numbers in parenthesis refer to this publication.

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Table 3

The Second Tier
Nine More Research Findings Identified by Key Informants As Explaining The Teaching Success Of Jaime Escalante

---

1. Solving Word Problems

   "Students will become more adept at solving math problems if teachers encourage them to think through a problem before they begin working on it, guide them through the thinking process, and give them regular and frequent practice in solving problems" (p. 29).

2. Illustrations

   "Well-chosen diagrams, graphs, photos and illustrations can enhance students' learning" (p. 34).

3. Tutoring

   "Students tutoring other students can lead to improved academic achievement for both student and tutor, and to positive attitudes toward coursework" (p. 46).

4. Assessment

   "Frequent and systematic monitoring of students' progress helps students, parents, teachers, administrators, and policy makers identify strengths and weaknesses in learning and instruction" (p. 54).

5. School Climate

   "Schools that encourage academic achievement focus on the importance of scholastic success and on maintaining order and discipline" (p. 58).

6. Discipline

   "Schools contribute to their students' academic achievement by establishing, communicating, and enforcing fair and consistent discipline policies" (p. 61).

7. Attendance

   "A school staff that provides encouragement and personalized attention, and monitors daily attendance can reduce unexcused absences and class-cutting" (p. 63).

8. Effective Principals

   "Successful principals establish policies that create an orderly environment and support effective instruction" (p. 64).

9. Preparation for work

   "Business leaders report that students with solid basic skills and positive work attitudes are more likely to find and keep jobs than students with vocational skills alone" (p. 81).

Note: All research findings were taken from What Works, Research on Teaching and Learning, Second Edition, published by the United States Department of Education, 1987. Page numbers in parenthesis refer to this publication.

Table 4

The Third Tier
The Bottom Seven Research Findings Identified by Key Informants As Explaining The Teaching Success Of Jaime Escalante

---

1. Counting

   "A good way to teach children simple arithmetic is to build on their informal knowledge. This is why learning to count everyday objects is an effective basis for early arithmetic lessons" (p. 11).

2. Science Experiments

   "Children learn science best when they are able to do experiments, so they can witness 'science in action'" (p. 24).

3. Estimating

   "Although students need to learn how to find exact answers to arithmetic problems, good math students also learn the helpful skill of estimating answers. This skill can be taught" (p. 25).

4. Learning Mathematics

   "Children in early grades learn mathematics more effectively when they use physical objects in their lessons" (p. 27).

5. Teacher Feedback

   "Constructive feedback from teachers, including deserved praise and specific suggestions, helps students learn, as well as develop positive self-esteem" (p. 45).

6. Memorization

   "Memorizing can help students absorb and retain the factual information on which understanding and critical thought are based" (p. 47).

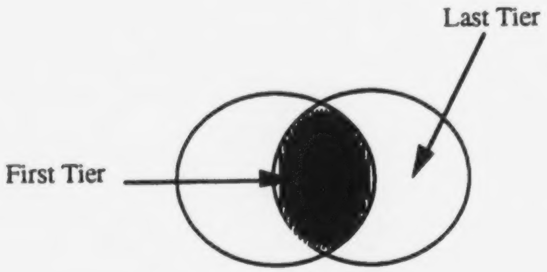
7. Questioning

   "Student achievement rises when teachers ask questions that require students to apply, analyze, synthesize, and evaluate information in addition to simply recalling facts" (p. 48).

Note: All research findings were taken from What Works. Research on Teaching and Learning. Second Edition, published by the United States Department of Education, 1987.

The pilot test showed that the approach taken here would work. Set A certainly exists; and Set B can be thought of as containing those teaching and motivating practices that are found in the booklet, What Works: Research About Teaching and Learning. Furthermore, Set A and Set B do intersect; that is, some practices listed in What Works are practices used by Escalante. (See Figure 4.)

Figure 4
Intersection of Sets A and B



Where: Set A = {The successful teaching and motivating practices of Mr. Jaime Escalante}

Where: Set B = {The successful teaching and motivating practices identified in the booklet, What Works}

The 15 research findings in the first tier (Table 2) were clearly judged to be "common"; that is, they are contained in both Set B and Set A.

The 28 research findings in the last tier (Table B-1 in Appendix B) were clearly judged to be in Set B but not in Set A. The pilot test showed that Mr. Escalante was right when he said it was possible to identify "common denominators"—practices in use by—"very effective teachers" that have "withstood the acid test of classroom performance." (Escalante and Dirmann, 1990, p. 6.)

Part 2
Judgments by Escalante's Calculus Students

As noted earlier, the primary interaction of interest is the teaching–learning interaction. There are only two categories of participants in this interaction; the teacher, Jaime, and his students, everyone else is either an observer or facilitator. While the judgments of observers can be very helpful, the judgments of the teacher and his students are essential. Angelo Villavicencio had observed Escalante for eight consecutive weeks and, while no other observer has been able to duplicate this, some of Escalante's students have been with him for several years.

Escalante's calculus students were chosen as the primary source of information about his teaching and motivating practices for several reasons. First, as students they were direct participants in the teaching–learning interaction. Second, they had Mr. Escalante as their math teacher for three or four years, so they knew him better than other students did. Third, they tended to be high school seniors who were planning to transition to college. They were, therefore, older and hopefully better able to be objective about their experiences with him.

The same approach that guided the data gathering from Escalante's colleagues (Part 1) was used to guide the data gathering from his calculus students except that this time, Set B, the set containing the successful teaching and motivating practices identified by prior research, was expanded.

In Part 1, Set B contained 59 research findings taken from What Works: Research on Teaching and Learning. (U.S. Department of Education, 1987.) In Part 2, Set B contained statements taken from the following three sources:

1) What Works: Research About Teaching and Learning (2nd ed.) 1987 published by the U.S. Department of Education

2) Motivation: What Research Says to the Teacher 1982 published by the National Education Association

3) The Jaime Escalante Math Program 1990 published by the National Education Association

In all, 75 statements about Mr. Escalante and his actions were created and presented to his calculus students by way of a questionnaire. (See Appendix C for a copy of the questionnaire.) Each statement had been derived from one or more of the three sources mentioned above. His students were asked to rate each statement; e.g., "Mr. Escalante is often funny or humorous," by assigning a number from minus nine to plus nine (-9 to +9) to each statement. Minus nine (-9) meant the student "very strongly disagreed" with the statement, while a plus nine (+9) meant that he "very strongly agreed" with the statement.

Escalante's calculus students were able to scatter the 75 statements across a continuum. Interestingly, the statement, "Mr. Escalante is often funny or humorous," rose to the top of the list with an average rating of 8.362 (range -9 to +9). Of all statements, this one was judged to be the one most like him. At the other end of the list was the statement, "Mr. Escalante encourages me to get involved in extra curricular activities to round out my education." This one had an average rating on only 1.674 (range -9 to +9) and was judged to be the one most unlike him. Please see Table 5 which follows.

TABLE 5

Rank Ordering of Selected Statements Regarding Jaime Escalante and His Teaching by His Calculus Students

Rank Order	Mean Rating by Calculus Students (n=47)	Original Questionnaire Statement Number	Statement
1	8.362	10	is often funny or humorous (Evaluator's classroom observations notes; NEA, 1990, p.7)
2	8.087	65	believes my first priority is to learn (USDOE, 1987, p. 58; NEA, 1990, p. 8)
3	8.022	64	puts academics first (USDOE, 1987, p. 58; NEA, 1990, p. 8)
4	7.978	14	expects me to work hard (USDOE, 1987, pp. 14, 15; NEA, 1990, p. 8)
5	7.957	7	expects me to achieve and do well in math (USDOE, 1987, pp. 35, 58; NEA, 1986, p. 22; NEA, 1990, p. 9)
6	7.891	75	has helped me understand that employers will want me to have a solid preparation in math, reading, writing, and problem solving (USDOE, 1987, p. 81)
7	7.766	3	is enthusiastic (NEA, 1986, p. 20)
7	7.766	4	is energetic (NEA, 1990, p. 8)
9	7.761	68	expects me to attend class, come to class on time, and meet the assignment deadlines (USDOE, 1987, pp. 35, 59; NEA, 1986, p. 22; NEA, 1990, p. 8)
10	7.574	11	is an excellent mathematician (NEA, 1990, pp. 7, 8, 10)
11	7.511	43	expects that I can and will learn a lot of math (USDOE, 1987, p. 35; NEA, 1986, p. 20; NEA, 1990, pp. 4, 9)
12	7.489	9	is cheerful (NEA, 1986, p. 20)
13	7.435	67	expects me to be honest, courteous, and to show respect for others (USDOE, 1987, p. 59; NEA, 1990, pp. 7, 11)
14	7.234	27	has helped me see that education is important (USDOE, 1987, p. 15; NEA, 1990, p. 9)
15	7.106	42	calls attention to diagrams, graphs, photos or illustrations that not only relate to the lesson but also help me learn and remember (USDOE, 1987, p. 34; NEA, 1990, p. 4)
16	7.022	53	encourages me to try harder by reminding me that people beyond our school are paying attention to how well we do (USDOE, 1987, pp. 43, 57)
17	7.000	46	has taught me rules and principles and the conditions under which they apply so I can solve math problems (USDOE, 1987, p. 38)
17	7.000	71	has helped me understand that I learn more in rigorous, tough courses than in courses that are easier (USDOE, 1987, p. 75; NEA, 1990, pp. 3, 4)
19	6.979	6	is friendly toward me (NEA, 1986, p. 20; NEA, 1990, pp. 9, 10)

Table 5

(continued)

Rank Order	Mean Rating by Calculus Students (n=47)	Original Questionnaire Statement Number	Statement
20	6.913	17	gives me a lot of math problems to do (USDOE, 1987, p. 14; NEA, 1990, p. 7)
21	6.891	62	has encouraged public recognition for students who succeed and promoted a sense of school pride (USDOE, 1987, p. 57)
22	6.745	18	helps me enjoy math (NEA, 1990, p. 7)
23	6.739	47	captures and holds my attention (USDOE, 1987, p. 39; NEA, 1990, p. 8)
24	6.723	21	has helped me set higher goals for myself in life (NEA, 1990, p. 9)
25	6.660	13	helps me see myself as a "winner" (USDOE, 1987, p. 35; NEA, 1986, p. 15; NEA, 1990, p. 9)
26	6.638	12	believes in me (USDOE, 1987, p. 35; NEA, 1986, p. 22; NEA, 1990, p. 9)
27	6.574	45	requires that faster learners put forth effort too; he won't let them just "coast" (USDOE, 1987, pp. 14, 37, 78)
28	6.553	16	gives me the help I need when I get "stuck" (USDOE, 1987, p. 45; NEA, 1990, pp. 8, 9)
29	6.532	25	has helped me understand that I can become qualified for any job I want (USDOE, 1987, p. 35; NEA, 1990, pp. 5, 9)
30	6.511	22	expects me to spend a lot of time on math (USDOE, 1987, pp. 15, 75)
31	6.457	52	takes us through the steps needed to solve a problem and explains the purpose of each step (USDOE, 1987, p. 41)
32	6.426	38	has helped me learn how to think through a word problem before I begin working on it; to analyze the challenges I face and explore alternative strategies before I start to work(USDOE, 1987, p. 29)
33	6.340	20	has helped me set higher goals for myself in math (USDOE, 1987, p. 35; NEA, 1990, p. 9)
33	6.340	37	has taught me to estimate answers to math problems so that I can reject unreasonable answers and know when an answer is "in the ballpark" (USDOE, 1987, p. 25)
35	6.298	19	has helped me become more interested in math (NEA, 1990, p. 7)
35	6.298	32	understands the world I will face after high school (NEA, 1990, p. 9)
37	6.277	15	helps me plan and strive for excellence (NEA, 1986, p. 18; NEA, 1990, p. 6)
38	6.261	66	expects and rewards my academic success (USDOE, 1987, pp. 35, 58; NEA, 1986, p. 22)
39	6.174	61	helps me see how new information relates to old information we have already covered (USDOE, 1987, p. 55)
40	6.085	8	is considerate of me (NEA, 1986, p. 20; NEA, 1990, pp. 9, 10)
41	6.065	74	would much rather I not take a part-time job that would require 15 hours or more per week of my time (USDOE, 1987, p. 80)
42	6.043	23	gives me math problems I can do if I paid attention during his lectures and did the assignments (USDOE, 1987, pp. 54, 55; NEA, 1990, pp. 7, 8)

Table 5
(continued)

Rank Order	Mean Rating by Calculus Students (n=47)	Original Questionnaire Statement Number	Statement
43	6.000	26	has helped me learn how to work hard and take responsibility for myself (USDOE, 1987, p. 14; NEA, 1990, p. 8)
43	6.000	72	has helped me see the advantage of advancing in math at a faster pace by attending summer school (USDOE, 1987, p. 78; NEA, 1990, p. 4)
45	5.979	41	refers back to experiences I have already had when he introduces new concepts (USDOE, 1987, pp. 54, 55; NEA, 1990, pp. 7, 8)
46	5.978	69	enforces discipline policies consistently and fairly (USDOE, 1987, p. 61)
47	5.915	5	is "warm" emotionally toward me (NEA, 1986, p. 20; NEA, 1990, p. 9)
48	5.894	39	has guided me through the thinking processes I need to understand in order to work word problems correctly (USDOE, 1987, p. 29; NEA, 1990, pp. 7, 8)
49	5.851	36	lets me know quickly why I got a math problem wrong and what I should have done and why (USDOE, 1987, p. 45; NEA, 1990, p. 8)
50	5.848	59	gives me homework that is useful, is an important part of classroom instruction, is evaluated by him and counts toward my grade (USDOE, 1987, p. 53)
51	5.745	29	has helped me understand that I as a learner need to be active not passive (USDOE, 1987, p. 39; NEA, 1986, p. 7; NEA, 1990, pp. 12, 13)
52	5.674	51	works personally with students to help them cope with especially difficult life situations ((USDOE, 1987, p. 40; NEA, 1990, p. 9)
53	5.596	35	lets me know quickly whether I did a math problem correctly or not (USDOE, 1987, p. 45)
54	5.574	30	has helped me see that I can control my own destiny (NEA, 1986, p. 18; NEA, 1990, pp. 5, 9.)
55	5.556	48	sequences what we cover in class so that my knowledge builds on itself and I am ready for the next step (USDOE, 1987, pp. 20, 39; NEA, 1990, pp. 7, 8)
56	5.522	54	praises successful aspects of my work and gives me detailed recommendations for how I can improve (USDOE, 1987, p. 45; NEA, 1990, p. 10)
57	5.478	56	has helped me memorize math facts by teaching highly structured and carefully sequenced lessons with feedback from him when I get correct answers (USDOE, 1987, p. 47)
58	5.468	40	has given me frequent practice in doing word problems (USDOE, 1987, p. 29; NEA, 1990, p. 8)
59	5.340	34	refers back to my prior knowledge when introducing new concepts (USDOE, 1987, pp. 54, 55; NEA, 1990, pp. 7, 8)
60	5.130	63	has promoted agreement by the principal, teachers, students, and parents on the goals, methods, subjects and topics to be taught (USDOE, 1987, p. 57)

Table 5

(continued)

Rank Order	Mean Rating by Calculus Students (n=47)	Original Questionnaire Statement Number	Statement
61	5.000	49	monitors each student's progress so that all of us are actively engaged in learning no matter how fast we learn (USDOE, 1987, p. 37; NEA, 1990, p. 10)
62	4.957	57	has helped me achieve more by asking both factual and more complex, thought-provoking questions (USDOE, 1987, p. 48)
63	4.848	60	monitors my progress frequently and systematically (USDOE, 1987, p. 54)
64	4.830	2	presents math lessons clearly (NEA, 1986, p. 20)
65	4.766	44	rewards slower learners for their progress and effort (USDOE, 1987, p. 37)
66	4.652	58	has helped me develop better study skills (USDOE, 1987, p. 49)
67	4.638	24	has helped me plan further into the future than I ever have before (NEA, 1990, pp. 5, 9)
68	4.574	1	is well organized (NEA, 1986, p. 20; NEA, 1990, pp. 7, 8)
69	4.447	28	manages our in-class time efficiently so that disruptions and wasted time are kept to a minimum (USDOE, 1987, p. 39; NEA, 1990, pp. 7, 8)
70	4.435	50	manages classroom time well by keeping wasted time and misbehavior to a minimum (USDOE, 1987, p. 39)
71	3.891	70	works with other math teachers at Garfield High to develop math related goals that emphasize student achievement (USDOE, 1987, p. 67)
72	3.600	55	provides me access to a math tutor whose assistance has helped me (USDOE, 1987, p. 46.)
73	3.234	31	understands what my life at home is like (NEA, 1990, p. 12)
74	2.872	33	has tried to get my parents to become involved and supportive of my school work (USDOE, 1987, p. 17; NEA, 1990, pp. 10, 11)
75	1.674	73	encourages me to get involved in extracurricular activities to round out my education (USDOE, 1987, p. 79)

Note: Statements were derived from research findings which were taken from the following three main sources: 1) What Works, Research on Teaching and Learning, Second Edition, published by the United States Department of Education, 1987; 2) Motivation: What Research says to the Teacher, published by the National Education Association, 1986; and 3) The Jaime Escalante Math Program, published by the National Education Association, 1990.

Part 3
Judgments by Escalante's Colleagues

In order for data triangulation to exist, the three data sources must supply information on the same thing. The primary data collection instrument is the one shown in Appendix C. This questionnaire was completed by Mr. Escalante's calculus students and the results were reported in Part 2. To meet the requirements of data triangulation, both Mr. Escalante and his colleagues needed to respond to all or part of that questionnaire.

Mr. Escalante's colleagues were asked to complete the same questionnaire (Appendix C) that his calculus students had completed. His colleagues ranked the seventy-five statements a bit differently. The ranking by his colleagues are shown in Table 6 below. So that a comparison can be made of how both groups responded, statements ranked as more like Mr. Escalante by his calculus students are identified in this table by the print that is both bold and italicized (see Table 6).

As can be seen in the table, there were only ten statements out of the top thirty-eight in this table that were identified by Escalante's colleagues but not by his calculus students (only ten were not printed in bold and italics.) Put another way, his colleagues identified twenty-eight of the thirty-eight statements identified as more like him by his calculus students. This fraction (28 + 38) equals 74 percent, so there is a 74 percent level of agreement between the two data sources (colleagues and students).

TABLE 6

Rank Ordering of Selected Statements Regarding Jaime Escalante and His Teaching by Key Informants

Rank Order	Ratings by Key Informants			Original Questionnaire Statement Number	Statement
	Mean (n=2)	Math Teacher	Assistant Principal		
1	9.0	9	9	1	is well organized (NEA, 1986, p. 20; NEA, 1990, pp. 7, 8)
1	9.0	9	9	2	presents math lessons clearly (NEA, 1986, p. 20)
1	9.0	9	9	3	*is enthusiastic (NEA, 1986, p. 20)*
1	9.0	9	9	4	*is energetic (NEA, 1990, p. 8)*
1	9.0	9	9	16	*gives me the help I need when I get "stuck" (USDOE, 1987, p. 45; NEA, 1990, pp. 8, 9)*
1	9.0	9	9	22	*expects me to spend a lot of time on math (USDOE, 1987, pp. 15, 75)*
1	9.0	9	9	39	has guided me through the thinking processes I need to understand in order to work word problems correctly (USDOE, 1987, p. 29; NEA, 1990, pp. 7, 8)
1	9.0	9	9	43	*expects that I can and will learn a lot of math (USDOE, 1987, p. 35; NEA, 1986, p. 20; NEA, 1990, pp. 4, 9)*
1	9.0	9	9	45	*requires that faster learners put forth effort too; he won't let them just "coast" (USDOE, 1987, pp. 14, 37, 78)*
1	9.0	9	9	46	*has taught me rules and principles and the conditions under which they apply so I can solve math problems (USDOE, 1987, p. 38)*
1	9.0	9	9	47	*captures and holds my attention (USDOE, 1987, p. 39; NEA, 1990, p. 8)*
1	9.0	9	9	48	sequences what we cover in class so that my knowledge builds on itself and I am ready for the next step (USDOE, 1987, pp. 20, 39; NEA, 1990, pp. 7, 8)
1	9.0	9	9	53	*encourages me to try harder by reminding me that people beyond our school are paying attention to how well we do (USDOE, 1987, pp. 43, 57)*
1	9.0	9	9	55	provides me access to a math tutor whose assistance has helped me (USDOE, 1987, p. 46.)
1	9.0	9	9	58	has helped me develop better study skills (USDOE, 1987, p. 49)
1	9.0	9	9	59	gives me homework that is useful, is an important part of classroom instruction, is evaluated by him and counts toward my grade (USDOE, 1987, p. 53)
1	9.0	9	9	62	*has encouraged public recognition for students who succeed and promoted a sense of school pride (USDOE, 1987, p. 57)*
1	9.0	9	9	65	*believes my first priority is to learn (USDOE, 1987, p. 58; NEA, 1990, p. 8)*
1	9.0	9	9	66	*expects and rewards my academic success (USDOE, 1987, pp. 35, 58; NEA, 1986, p. 22)*

Table 6
(continued)

Rank Order	Ratings by Key Informants: Mean (n=2)	Math Teacher	Assistant Principal	Original Questionnaire Statement Number	Statement
1	9.0	9	9	67	expects me to be honest, courteous, and to show respect for others (USDOE, 1987, p. 59; NEA, 1990, pp. 7, 11)
1	9.0	9	9	68	expects me to attend class, come to class on time, and meet the assignment deadlines (USDOE, 1987, pp. 35, 59; NEA, 1986, p. 22; NEA, 1990, p. 8)
1	9.0	9	9	69	enforces discipline policies consistently and fairly (USDOE, 1987, p. 61)
1	9.0	9	9	72	has helped me see the advantage of advancing in math at a faster pace by attending summer school (USDOE, 1987, p. 78; NEA, 1990, p. 4)
1	9.0	9	9	75	has helped me understand that employers will want me to have a solid preparation in math, reading, writing, and problem solving (USDOE, 1987, p. 81)
25	8.5	9	8	6	is friendly toward me (NEA, 1986, p. 20; NEA, 1990, pp. 9, 10)
25	8.5	9	8	7	expects me to achieve and do well in math (USDOE, 1987, pp. 35, 58; NEA, 1986, p. 22; NEA, 1990, p. 9)
25	8.5	9	8	8	is considerate of me (NEA, 1986, p. 20; NEA, 1990, pp. 9, 10)
25	8.5	9	8	9	is cheerful (NEA, 1986, p. 20)
25	8.5	9	8	10	is often funny or humorous (Evaluator's classroom observations notes; NEA, 1990, p.7)
25	8.5	9	8	11	is an excellent mathematician (NEA, 1990, pp. 7, 8, 10)
25	8.5	9	8	12	believes in me (USDOE, 1987, p. 35; NEA, 1986, p. 22; NEA, 1990, p. 9)
25	8.5	9	8	13	helps me see myself as a "winner" (USDOE, 1987, p. 35; NEA, 1986, p. 15; NEA, 1990, p. 9)
25	8.5	9	8	14	expects me to work hard (USDOE, 1987, pp. 14, 15; NEA, 1990, p. 8)
25	8.5	9	8	15	helps me plan and strive for excellence (NEA, 1986, p. 18; NEA, 1990, p. 6)
25	8.5	9	8	18	helps me enjoy math (NEA, 1990, p. 7)
25	8.5	9	8	19	has helped me become more interested in math (NEA, 1990, p. 7)
25	8.5	9	8	20	has helped me set higher goals for myself in math (USDOE, 1987, p. 35; NEA, 1990, p. 9)
25	8.5	9	8	21	has helped me set higher goals for myself in life (NEA, 1990, p. 9)
25	8.5	9	8	29	has helped me understand that I as a learner need to be active not passive (USDOE, 1987, p. 39; NEA, 1986, p. 7; NEA, 1990, pp. 12, 13)
25	8.5	9	8	30	has helped me see that I can control my own destiny (NEA, 1986, p. 18; NEA, 1990, pp. 5, 9.)
25	8.5	9	8	35	lets me know quickly whether I did a math problem correctly or not (USDOE, 1987, p. 45)

Table 6
(continued)

	Ratings by Key Informants				
Rank Order	Mean (n=2)	Math Teacher	Assistant Principal	Original Questionnaire Statement Number	Statement
25	***8.5***	***9***	***8***	***37***	***has taught me to estimate answers to math problems so that I can reject unreasonable answers and know when an answer is "in the ballpark" (USDOE, 1987, p. 25)***
25	8.5	9	8	40	has given me frequent practice in doing word problems (USDOE, 1987, p. 29; NEA, 1990, p. 8)
25	8.5	9	8	41	refers back to experiences I have already had when he introduces new concepts (USDOE, 1987, pp. 54, 55; NEA, 1990, pp. 7, 8)
25	***8.5***	***9***	***8***	***42***	***calls attention to diagrams, graphs, photos or illustrations that not only relate to the lesson but also help me learn and remember (USDOE, 1987, p. 34; NEA, 1990, p. 4)***
25	8.5	9	8	50	manages classroom time well by keeping wasted time and misbehavior to a minimum (USDOE, 1987, p. 39)
25	8.5	9	8	51	works personally with students to help them cope with especially difficult life situations ((USDOE, 1987, p. 40; NEA, 1990, p. 9)
25	***8.5***	***9***	***8***	***52***	***takes us through the steps needed to solve a problem and explains the purpose of each step (USDOE, 1987, p. 41)***
25	8.5	9	8	57	has helped me achieve more by asking both factual and more complex, thought-provoking questions (USDOE, 1987, p. 48)
25	8.5	9	8	61	helps me see how new information relates to old information we have already covered (USDOE, 1987, p. 55)
25	8.5	9	8	63	has promoted agreement by the principal, teachers, students, and parents on the goals, methods, subjects and topics to be taught (USDOE, 1987, p. 57)
25	***8.5***	***9***	***8***	***64***	***puts academics first (USDOE, 1987, p. 58; NEA, 1990, p. 8)***
25	***8.5***	***9***	***8***	***71***	***has helped me understand that I learn more in rigorous, tough courses than in courses that are easier (USDOE, 1987, p. 75; NEA, 1990, pp. 3, 4)***
25	8.5	9	8	74	would much rather I not take a part-time job that would require 15 hours or more per week of my time (USDOE, 1987, p. 80)
55	***8.0***	***9***	***7***	***17***	***gives me a lot of math problems to do (USDOE, 1987, p. 14; NEA, 1990, p. 7)***
55	8.0	7	9	23	gives me math problems I can do if I paid attention during his lectures and did the assignments (USDOE, 1987, pp. 54, 55; NEA, 1990, pp. 7, 8)
55	8.0	8	8	24	has helped me plan further into the future than I ever have before (NEA, 1990, pp. 5, 9)
55	8.0	8	8	28	manages our in-class time efficiently so that disruptions and wasted time are kept to a minimum (USDOE, 1987, p. 39; NEA, 1990, pp. 7, 8)
55	8.0	8	8	36	lets me know quickly why I got a math problem wrong and what I should have done and why (USDOE, 1987, p. 45; NEA, 1990, p. 8)

Table 6
(continued)

Rank Order	Ratings by Key Informants			Original Questionnaire Statement Number	Statement
	Mean (n=2)	Math Teacher	Assistant Principal		
55	***8.0***	***8***	***8***	***38***	***has helped me learn how to think through a word problem before I begin working on it; to analyze the challenges I face and explore alternative strategies before I start to work (USDOE, 1987, p. 29)***
55	8.0	8	8	54	praises successful aspects of my work and gives me detailed recommendations for how I can improve (USDOE, 1987, p. 45; NEA, 1990, p. 10)
55	8.0	8	8	56	has helped me memorize math facts by teaching highly structured and carefully sequenced lessons with feedback from him when I get correct answers (USDOE, 1987, p. 47)
55	8.0	7	9	60	monitors my progress frequently and systematically (USDOE, 1987, p. 54)
64	7.5	7	8	44	rewards slower learners for their progress and effort (USDOE, 1987, p. 37)
65	7.0	9	5	5	is "warm" emotionally toward me (NEA, 1986, p. 20; NEA, 1990, p. 9)
65	***7.0***	***6***	***8***	***25***	***has helped me understand that I can become qualified for any job I want (USDOE, 1987, p. 35; NEA, 1990, pp. 5, 9)***
65	7.0	6	8	26	has helped me learn how to work hard and take responsibility for myself (USDOE, 1987, p. 14; NEA, 1990, p. 8)
65	7.0	7	7	34	refers back to my prior knowledge when introducing new concepts (USDOE, 1987, pp. 54, 55; NEA, 1990, pp. 7, 8)
69	4.0	5	3	73	encourages me to get involved in extracurricular activities to round out my education (USDOE, 1987, p. 79)
N/A		Blank	9	***27***	***has helped me see that education is important (USDOE, 1987, p. 15; NEA, 1990, p. 9)***
		Blank	9	31	understands what my life at home is like (NEA, 1990, p. 12)
		Blank	9	***32***	***understands the world I will face after high school (NEA, 1990, p. 9)***
		Blank	9	33	has tried to get my parents to become involved and supportive of my school work (USDOE, 1987, p. 17; NEA, 1990, pp. 10, 11)
		Blank	9	49	monitors each student's progress so that all of us are actively engaged in learning no matter how fast we learn (USDOE, 1987, p. 37; NEA, 1990, p. 10)
		9	5	70	works with other math teachers at Garfield High to develop math related goals that emphasize student achievement (USDOE, 1987, p. 67)

Note: Statements were derived from research findings which were taken from the following three main sources: 1) What Works: Research on Teaching and Learning, Second Edition, published by the United States Department of Education, 1987; 2) Motivation: What Research says to the Teacher, published by the National Education Association, 1986; and 3) The Jaime Escalante Math Program, published by the National Education Association, 1990. Statements in bold and italicized are those identified by his calculus students to be more like him.

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Part 4
Interview with Jaime Escalante

The primary purposes of the interview were twofold. First, to see if Mr. Escalante agreed or disagreed with the statements about him which his calculus students had identified as most like him. For example, did he agree or disagree that he was "often funny or humorous?" (He did.) Second, to identify any teaching and motivating practices which had been left out. (See list of "Final Tasks" following Figure 3.) Were there other major techniques or methods or practices he used that had not been identified and discussed? (He identified several.)

It was during the summer session of 1991 and Jaime had just finished teaching his trig/math analysis class which met in a temporary building on the East Los Angeles College campus. He said he would rather do the interview in a room at the Escalante Math Project office. Mr. Escalante, Matthew Galvin, and I walked across campus with Mat carrying his video camera.

The project director, George Madrid, said, "Here, use my office." Mat adjusted his equipment and the interview began. We talked about "GANAS" (strong desire), the demographics of his students, the first thirty-eight statements identified by his calculus students as more like him, and the practices he uses which we had not yet identified. Many of those additional practices revolved around enlisting the support of the parents. (See Appendix J for Jaime's contract which requires the parents' signature.) As the interviewer, I thoroughly enjoyed myself. To me, this exceptional teacher is captivating and demanding as well as warm and caring toward his students; he is also funny and inspirational. He seemed to enjoy our time together too; at least he stayed and talked for over an hour.

Here is what he had to say. Here is the edited transcription of that interview.

ESCALANTE INTERVIEW

Dr. Kester: Hello. My name is Don Kester. I am a consultant in program evaluation at the Los Angeles County Office of Education. I am the external program evaluator for the Jaime Escalante Math Project. This project is funded by the National Science Foundation (NSF) and ARCO. It has been in operation for the last three years, 1989, 1990, and 1991, and while certain activities will continue through June, 1992, this summer--the summer of 1991--is the last summer of the project, and the last summer during which Mr. Escalante will be acting as a math teacher. This fall he leaves southern California to go to Sacramento to teach math there. A grant application is being prepared to support his efforts there; and that project may also be called the "Jaime Escalante Math Project." In the future, he plans to act as a consultant to this southern California project, which we probably should call, the "Original" Jaime Escalante Math Project.

We are here to interview Mr. Escalante about the development of an "instructional manual." This manual was promised in the original 1988 grant application to NSF. The manual was to describe the "very successful teaching and motivating methods" he uses.

Now before we begin the interview, I need to mention several references that may come up in the discussion. These references are:

1. The booklet entitled, "WHAT WORKS: Research About Teaching And Learning", Second Edition, published by the United States Department of Education (USDOE),
2. The booklet entitled, "MOTIVATION: What Research Says To The Teacher" published by the National Education Association (NEA),
3. The journal article entitled, "The Jaime Escalante Math Program" by Mr. Escalante and Jack Dirmann, reprinted by NEA, and

4.) The book entitled, ESCALANTE The Best Teacher in America, by Jay Matthews.

To provide a basic, theoretical framework that would guide the investigation to identify and describe his teaching and motivating methods, research findings from the first two references were relied upon heavily. Research findings were turned into statements about Mr. Escalante and his teaching; e.g., "Mr. Escalante expects me to achieve and do well in math." This particular statement was developed from a page on "Teacher Expectations" in WHAT WORKS (p. 35). On a questionnaire, Mr. Escalante's calculus students were asked to rate each of seventy-five research-based statements on a scale from minus nine (Very Strongly Disagree) to plus nine (Very Strongly Agree). Using the ratings given, the statements were then rank-ordered from the one that was most like him, "...is often funny or humorous", to the one least like him, "...encourages me to get involved in extracurricular activities...". For this interview, we will ask Mr. Escalante to react to the first thirty-eight statements that were rated as more like him.

Dr. Kester: Let's go over now to interview Mr. Escalante, the man who has been called, "The Best Teacher in America." (The title of the best selling book about you.) Mr. Escalante, it must be a great source of pride and satisfaction to you to know that you have changed hundreds of lives of students over the years.

Mr. Escalante: At Garfield High School we feel really great when we see these kids going to the best colleges and universities of the nation. I have kids in USC, UCLA, MIT--you name it. The only thing I don't like is the title, "Escalante, the Best Teacher in America." I know there are many other great teachers in America.

Dr. Kester: You have received praise over the years for the wonderful things you've done and in my view you deserve all the praise you've received and more. I want to take this opportunity to thank you for letting me into your class to observe, because I thoroughly enjoyed that. In fact, I not only enjoyed it I was inspired by what I saw and heard.

Mr. Escalante: Thank you, it was fun.

Dr. Kester: Now as we go through each statement that the students in your calculus class said was like you, please let me know if you think the statement is true or not, give some examples of what you do that illustrate the statement, and if it isn't really obvious, please describe how this attribute of yours or this teaching style of yours helps the students learn.

Mr. Escalante: Doing mathematics is fun. That's what I'm trying to put across to the students. Another key factor is keeping them for three consecutive years so you don't break the continuity. That's when kids come to realize that math is fun.

Dr. Kester: Let's get something straight right at the outset, too. Your students are not gifted students, they're not students with high test scores, they're not students with high grade point averages. These are typical students from this area of East Los Angeles.

Mr. Escalante: It is true we have a homogeneous class. Most of the kids are Mexican-Americans. Also it's true the kids are not motivated to do any math and they don't like to be involved in academic classes. One of my first functions was to motivate them to be in my program and eventually in any college they choose.

Dr. Kester: The research that we've done shows that 99 percent of the students are from an ethnic minority group and that when we looked closely at income level, we found that the median income for a typical (median) family of five was about $16,500 a year. We also found that 57 percent of fathers had not finished high school and 21 percent had finished high school only. So this is the population with which you're working.

Mr. Escalante: Yes, a majority of the parents have not graduated from high school. And so, in many cases they're not really happy about their kids going on to college. That's one of the things we have to face.

Dr. Kester: Given this student population and the fact that you're taking typical students, would you like to talk a minute about "GANAS"?

Mr. Escalante: GANAS is a strong word in the language the kids use at home. It means desire. I tell the kids that once you have GANAS, the rest is easy. The only thing we need from you is just put a little time and desire to do it.

Dr. Kester: Let's proceed to the research-based statements taken from the sources mentioned earlier, and the listing of those statements that comes from your calculus students who filled out a questionnaire in May 1990. These statements are listed in rank order beginning with the statement judged to be most like you. At the top of this list is, "Mr. Escalante is often funny or humorous." My first question is, "Does this ring true to you?"

Mr. Escalante: I believe we have to have fun, we have to have jokes to capture the attention of these kids. If the teacher is dry and walks into the room and walks straight forward to say, "Open your books to page so-and-so" he's not going to get the response I'm looking for. The teacher has to have three basic things to be able to capture the attention of these kids. Number one, he or she has to know the subject. Secondly, to motivate, I have a lot of fun, making jokes to motivate these kids. Thirdly, there must be a positive relationship between the students and the teacher. And as I've said, I like to keep them for three consecutive years.

Dr. Kester: So the students in your calculus class who filled out these questionnaires were with you for three years?

Mr. Escalante: Yes, they were. In some cases it was more than three years. I have cases in which kids from junior high come to me and say, "I want to be in your class." I say, "Okay, no problem. You can be in my class." But immediately the kid says, "I'm going to be there for only one semester." That's when I have to say "No, the math you take from me is not one semester or one year. It's going to be three years. After you see whether you can learn from me, you spread the word into the other schools that doing math is fun."

Dr. Kester: The third statement is, "Mr. Escalante believes my first priority is to learn."

Mr. Escalante: Yes, any kid will learn. Any kid can do it. I tell the students, "I think you can learn. You can prove to me that you can do it. I do not believe in 'gifted' you don't have to be gifted to be able to learn." That will always be my philosophy.

Dr. Kester: The next one is, "...(He) puts academics first."

Mr. Escalante: True. It's okay for youngsters to participate in sports, but that has to be limited. In order to have academic achievement, I say to the kids, "Look, you guys, realize that what you're learning in this class is something your going to be applying later on in your life." Mathematics is the language you have to learn. That's why academics come first. We have to live according to the new technology. You have to have chemistry, physics, biology, and so on for high tech careers, and the language is mathematics. You can play football, basketball, whatever, but the first thing you have to keep in mind is that education is the ticket to success.

Dr. Kester: Well, they have certainly gotten that message, according to how they answered the questionnaire. "Mr. Escalante expects me to work hard."

Mr. Escalante: In our classroom, we say you'll attain success only if you work hard. Nothing comes easily. You have to produce. You just set up goals and go for it. At the same time, I teach values in the class. I say, "Look, it's not just to learn math-it's also to learn respect including respect for the flag."

Dr. Kester: Now, the second highest-ranked statement that they gave us was, "Mr. Escalante expects me to achieve and do well in math."

Mr. Escalante: I always say that I build the confidence in the kids. I say to them, "Believe in yourself. If you believe in yourself, you're going to be able to do it and you're going to think positively." Believing in yourself means building confidence. If you believe in yourself, that's a giant step to success. I expect from you much more than you think you can do.

Dr. Kester: The next one is, "Mr. Escalante has helped me understand that employers will want me to have a solid preparation in math, reading, writing, and problem solving."

Mr. Escalante: When you look for a job, whoever might hire you is not interested in what your problems are. He is interested in what you know. I spent more than eight years working in industry. I know employers look for productive and effective employees. Teachers need to give children the solid preparation they'll need to get and hold good jobs.

Dr. Kester: They also say that you are both "enthusiastic" and "energetic."

Mr. Escalante: When the teacher walks into the room, it has to be with a lot of energy. A teacher has to have the energy of the hottest volcano, the precision of the best calculator, and the memory of an elephant. Every time I walk into the room I remember exactly where I left the day before. Besides that, I always have fun with the kids. I do say that I bring to the school and the classroom GANAS every single day.

Dr. Kester: They say you expect each of them, "...to attend class, come to class on time, and meet the assignment deadlines."

Mr. Escalante: One of the things that's important in a classroom is discipline. They can come to my early-morning class 10-20 minutes or one hour before it starts, because they always know the teacher is always there one hour early. I'm in the classroom at 7 o'clock and they know I'm the last one leaving the school. School ends at 3 o'clock and I'm still in school until 4 or 5 o'clock in order to help these kids to achieve what they have in mind. I know at home they don't have the help they need, so I have to provide that help after and before school. I ask the kids to be always on time. If I do not control the classroom this way, later on the picture will change. The kids will give up or drop out. When I have this control, the students are going to produce and they're going to be able to continue.

Dr. Kester: This you alluded to earlier, "Mr. Escalante is an excellent mathematician."

Mr. Escalante: Well, it's no trick doing math. The first teacher we have is the experience. I learned math by doing it. And my grasp of my subject has deepened with more than 20 years of teaching experience.

Dr. Kester: Before the first bell even rings for the new year, you have everything already planned. You have prepared all of your worksheets and all of your presentations before your first class even meets.

Mr. Escalante: I have my lesson plans made up 20 weeks in advance. I have the file cabinets ready to use for the 20 weeks at the same time, making corrections and changing problems to really go according with the new technology. That helps to improve my teaching in first place and in second place prepare these kids for life. I do have my own handouts and my own problems. That doesn't mean I don't use the books--I do use the books, because I feel that the textbooks are a good reference for the students, but I feel confident when I use my own papers.

Dr. Kester: For the next one, your calculus students said, "Mr. Escalante is cheerful."

Mr. Escalante: Well, if the kids said that, it's because I'm really proud of my students.

Dr. Kester: This you touched on earlier when you mentioned values; ". . .expects me to be honest, courteous and show respect for others."

Mr. Escalante: We have to teach our kids values, the great things we have in this country. It's not unusual for me to start talking about the patriotic symbols and the great things this country did and the great men we had. I teach responsibility.

Dr. Kester: You mentioned this earlier also, ". . .has helped me see that education is important."

Mr. Escalante: Education is the ticket to success. It's the only way we are going to be able to keep with the other countries. I feel that 10-15 years old is the critical age. That's when we have to motivate these kids, to show that through education you can achieve, or get a job easily, or prepare for a profession, going to a four year college or three year college. I don't require all my kids to be majors in chemistry, physics, mathematicians, or pre-med. No. But I tell them, 'you could be a good technician, but you need education.'

Dr. Kester: They say you call "...attention to diagrams, graphs, photos, or illustrations that not only relate to the lesson but also help me learn and remember."

Mr. Escalante: It's important to visualize mathematics to make it come alive. In my teaching, I do use drawings and some practical examples and so the student can picture it. Also, every time we go through word problems I ask them to tell me what kind of picture or graph could be made of it. 'Can you visualize what the problem is?' I ask. Doing this every day, the kids get familiar with that approach; they know a diagram or a picture helps you solve the problem.

Dr. Kester: When I was in your Algebra II class, I saw you grab your chalk and draw a diagram on the floor instead of putting it on the blackboard. The kids got up out of their seats to gather around you. Judging by their faces, they were asking themselves, "Now, what's he doing this time?"

Mr. Escalante: I try to capture the attention of the kids, it's true. The other day, for instance, I walked into the classroom with my hands in my pockets. The whole class was looking at me because I was walking with my two hands inside my pockets. Immediately some of the kids said, "What do you have in there?" My answer was "Nothing." "You got something in there!" "No, nothing." "He is going to show us something." That's what I expect from the kids: "He is going to teach us something new, that's why he is hiding something." It's just to bring mathematics alive and capture the kids' attention.

Dr. Kester: "...encourages me to try harder by reminding me that people beyond our school are paying attention to how well we do."

Mr. Escalante: One of things that's important in the classroom is to tell the kids, "Look--people are always watching you, looking at you, learning from you. You're an inspiration, did you know that?" And the kids ask "Do you think so?" "Yeah, yeah." I tell them and I know you're going to make it. Also, I use examples. I say you know the famous baseball pitchers have to pace themselves. "Don't look back, maybe something is gaining on you." If you really put little GANAS, your mom, your teacher, everybody will be proud of you. You really made it.

Dr. Kester: The next one is, "...has taught me rules and principles and the conditions under which they apply so I can solve math problems."

Mr. Escalante: Absolutely. That's building up their skills so they can get the answers easily. I'm really pleased with that kind of remark from the students.

Dr. Kester: One of the things that was brought out in the movie, "Stand and Deliver" relates to the next one. "Mr. Escalante has helped me understand that I learn more in rigorous, tough courses than in courses that are easier."

Mr. Escalante: When you have an easy class, the students like to take it easy, kicking back. But if you make it a little difficult gradually, the kids are going to respond. What I'm doing is challenging them. That's why I say to them, "Algebra I is a piece of cake. What we are going to do is calculus, the next one.'" So really what they are doing is Algebra II, but toward calculus. It's challenging them. I have good feedback from doing that.

Dr. Kester: The next one is, "...Mr. Escalante is friendly toward me."

Mr. Escalante: One of the things that's important in teaching is that you have to show love, unlimited love but with the one kind of compensation for me: they have to do their assignment, their homework. When I show that kind of appreciation or love, the kids give you the feedback. But I have to cultivate that for the three years and so I say to them, you're my friend. I'm just the coach. Since you're my friend, you can do any mathematical assignment that I ask you to do.

Dr. Kester: "...gives me a lot of math problems to do." You work them pretty hard, don't you?

Mr. Escalante: Yes sir, we have a minimum of 20 problems a day in the classroom, so the kids understand what's going on. Once they get the picture, they're going to be able to do their homework I give more than normally they have to do, because practice comes first. Gradually, year by year, I increase the number of problems the kids have to be doing in the classroom.

Dr. Kester: You're accelerating these students too. In your journal article, you mentioned that you're getting these students through six years worth of math in three years.

Mr. Escalante: Yes, I do, actually; I put them on the spot. Ten to fifteen years old is the initial period of puberty. They develop more rapidly than in any other phase of life. I take advantage of that. I say, these kids have the chance to be able to produce, because the 10-15 years old, they think in a complex way. I take advantage of that doing math.

Dr. Kester: You alluded to this before, "...helps me enjoy math."

Mr. Escalante: Oh, it's fun. You have to have some jokes in the class, and do some shortcuts. I make them believe I'm a magic man and they're going to be magic men too if they do these shortcuts. Math has so many beautiful things to be able to do to capture the attention of the kids. I do these things and they enjoy it. They like to do math.

Dr. Kester: "...has encouraged public recognition for students who succeed and promoted a sense of school pride." You were setting up competitions even in La Paz, Bolivia. Now it's "Beat Educational Testing Service (ETS)!" But you've always used competition and public recognition, haven't you?

Mr. Escalante: Yes. This way it's much, much better, because every time we have a competition in mathematics, we are the first to send anybody to be in the competition from that school. But we do concentrate more on the Advanced Placement Exam because I feel that's a good gate, a way to analyze what we are doing wrong in the schools, also one way to find out the corrective action to be able to work toward improvement in academics. I feel that the Advanced Placement Test is a first-class test. I say to the kids that when you go to take that test you're going to "Beat ETS, Beat ETS, Beat ETS!" Also I make them believe that Garfield High School is the only school that could compete with the Japanese. The kids build that idea starting at the 10th grade. So when they're in the last year, their senior year, always they say, "Do you think we can beat them?" "I think so, I think so." You have to push a little bit more and you will see them achieve.

Dr. Kester: In talking with your program staff, George Madrid, Paul Powers, and Kevin Galvin, they said that the numbers look even better this year. They always look good, but both the number of students taking the Advanced Placement Exam in calculus, and the number passing continues to look just great.

Mr. Escalante: We have to improve—that's one way to look at it. This year we have lots of calculus students ready to take the test, and even though I have so many things to do besides my teaching assignments. We have so many visitors from different parts of the country, different schools, teachers, even people from Japan are coming to see the techniques we use to motivate these kids. That takes away my teaching time. Besides that, I get invitations from different states to share this kind of program we have. I feel obligated to do that. Even though I'm really proud of the students, the test results would be much, much better if I just concentrated on my students as I used to do.

Dr. Kester: "...has helped me set higher goals for myself in life."

Mr. Escalante: You know in East Los Angeles, kids don't have too many expectations of themselves. I say to them, "You could become a teacher, you could become an engineer, a doctor or anything you want, because through the program I have and through education you're going to see tomorrow is a better day, you're going to be much, much better than me." The kid keeps that kind of picture in mind, and it pays off. I'm proud to say that at this stage I have engineers and doctors who are former students. In fact, the Advanced Placement computer teacher, Roy Marcus, here at Garfield, is a former student of mine from 1982. He's well known as one of the top teachers in California in computers. Roy says "we have too much competition going with you."

Dr. Kester: The next statement they say is like you is, "...has helped me see myself as a winner."

Mr. Escalante: Always, always. I expect my kids to be winners. You expect kids to be losers, they will be losers. If you hold them accountable for what they do, they will amaze you. I have seen it happen at Garfield High School during the last 18 years.

Dr. Kester: "Mr. Escalante believes in me."

Mr. Escalante: That's right, I do 100 percent trust in the kids. I do say this in the class,--"I believe in your success, I believe you're going to do it, I believe in you on a one-to-one basis." Eventually the kid starts believing that.

Dr. Kester: "...(He) captures and holds my attention." This was something I noticed right away when I was an observer in your classes. It seemed to me that you didn't just ask for my attention, you took it. It was next to impossible for me not to attend to you and what you were talking about.

Mr. Escalante: Yes, a teacher has to have that. I know what the kids are doing even though I'm not looking at them. When I'm in front of the students at the chalkboard, the first thing I have to do is to have to get the attention of each of my students. In the beginning it looked difficult. Now it comes naturally. I do have, I should say, that quality.

Dr. Kester: Yes, you do, you certainly do. The next one is, "...requires that faster learners put forth effort too; he won't let them just coast."

Mr. Escalante: Yes, you don't need to be a smart teacher to know which ones are catching the whole image at one shot. So, I have to take advantage of those and give them a little bit more to keep them producing, because if I ignore them I might lose them. I have to keep motivating them and give them a little more. But it's amazing what they learn. In the end I'm really proud of these kids doing these wonderful things.

Dr. Kester: You let them work as teams, too, don't you?

Mr. Escalante: It's really important to work in teams. That comes from my experience in industry. I found that cooperation and communication are necessary to the smooth running of a business. It's cooperative learning and so we have to teach that kind of environment in the school. What I do is group four or five kids. The weak kid is the leader. I say, you're going to be the lead man or lead lady, so you'll answer any questions. Some times the weak kids says, "I don't understand too much." I reply, that's no big deal, you come in the morning or in the afternoon and I will teach you what we're going to be doing. Working in groups is productive; they learn more than on a one-to-one basis.

Dr. Kester: "...gives me the help I need when I get stuck." But how do you know when they get stuck?

Mr. Escalante: From the face of the kid, immediately.

Dr. Kester: But you have large classes. Last summer I saw sixty or more students in your Trig/Math Analysis class.

Mr. Escalante: Yes, I had about seventy-three students.

Dr. Kester: Seventy-three students!

Mr. Escalante: What I do is simple. When the class is working and the kid starts tapping his pencil on the paper and looking to the sides, I know the kid is a little frustrated. In order to avoid that kind of negative response, I initiate a conversation with him, with a joke. The kid starts building confidence, and I go step-by-step, the kid sees what the problem is. Then I give him another one similar to that, and build up his confidence.

Dr. Kester: "...has helped me understand that I can become qualified for any job I want."

Mr. Escalante: Anybody could be qualified for a job they want if they put just the GANAS into it. When they work in the classroom, they build that. In order to help students build strong belief in themselves, I use posters of famous players and examples of great people. I always say that you guys have math in your blood. You know the Mayas were the big mathematicians. So, all you have to do is use your logic, and you're going to be able to succeed.

Dr. Kester: A lot of the statements that we are getting to now sound similar to ones we've talked about before. This is because statements were taken from different sources. One review of research concerned motivation, while another one focused on teaching and learning. So, some statements are similar but not exactly the same. This next one is similar to earlier ones, too. "...(He) expects me to spend a lot of time on math."

Mr. Escalante: Yes, it's true. Math is just practice.

Dr. Kester: "...has helped me learn how to think through a word problem before I begin working on it; to analyze the challenges I face and explore alternative strategies before I start to work."

Mr. Escalante: That's one of the things that's important. If I'm the quarterback, I'm not going to throw the ball to just anybody. I have to look for an open receiver. That's exactly how to solve a problem. You look at the problem and know what kind of tool you need. Use it to solve the problem. You don't have to memorize formulas. The formulas are tools, and the tools become familiar to you using them every day. Each student does not have to be a great mathematician. Mathematics is just using tools correctly.

Dr. Kester: Now, earlier we had an item that was higher in this list that said, "...has helped me set higher goals for myself in life", and this one is similar to it. But it's interesting to notice that this one is further down the list; "...has helped me set higher goals for myself in math."

Mr. Escalante: I ask myself what is the future for my students? The future is in chemistry, physics, biology, computers, electronics, and other high tech fields, but the language is mathematics. Math will open the doors for you.

Dr. Kester: "...has taught me to estimate answers to math problems so that I can reject unreasonable answers and know when an answer is 'in the ball park'."

Mr. Escalante: That's correct--math is just estimation. Mathematics is just to approximate. So I look at the kid and I say I think you are 14 or 15 years old. And the kid says "No, I'm 14." "I'm just estimating, you know?" I say, look I have $20. I could spend only $2. I'm hungry, I have to eat so I have no choice--I have to go to McDonald's if I want to spend only $2. I'll spend only $2 so I can save $18. This is what math is. That's what you do if I ask you what time it is. You might say you think it's 12 o'clock without looking at the clock. That's math estimation.

Dr. Kester: "...takes us through the steps needed to solve a problem and explains the purpose of each step."

Mr. Escalante: This is the nice thing in math. Step-by-step and you come out with the right solution. You really feel satisfaction. I don't want the kids to be sloppy. I want them to follow the steps they have to know. If you get stuck, go to the picture, go to the graphic. If the graphic does not help, you try to find some other appropriate tool. It's going to be a formula or an equation. You have to be practical. This is the only way to master mathematics.

Dr. Kester: "...has helped me become more interested in math."

Mr. Escalante: Kids enjoy listening to me talk about the history of math. In the beginning, for instance, who invented the number one, number two, and so on? Who started with the numbers? I draw a picture with a square and I say, "The one came from here, from the square and the two came from here" and so on. That's fascinating and the kids say, "I like to do math, I like math."

Dr. Kester: "Mr. Escalante understands the world I will face after high school."

Mr. Escalante: Naturally. Nothing comes easily. You have to be prepared for life and work. Your mom and dad will not always be helping you. You have to know how to fill out a job application neatly, because if the employer cannot read the name of the applicant, they won't even call for an interview. So, you have to be neat, you have to be able to answer the questions. For instance, if you're applying for a job in electronics and they ask you what's your hobby, you shouldn't say fishing. No, you have to say I like electronics, I like to build this and that. If you say I like fishing you're probably not going to get the job. These things you have to know. That's one of the things I was saying in the beginning. That's why we have to teach values, we have to teach them something else besides the subject we are teaching.

Dr. Kester: "...helps me plan and strive for excellence."

Mr. Escalante: Absolutely. That's exactly what I was going to say, I was ahead of you.

Dr. Kester: Yes, you were ahead of me, that's right. "...expects and rewards my academic success."

Mr. Escalante: I have good connections with McDonald's. They provide coupons. For instance, today two kids were waiting for recognition, and they told me, "Today is my birthday" they know I'll present the coupon for their birthday. But if they do well in a test, or if I see improvement, they know they'll get a jacket with a bulldog (for the advanced placement calculus students) or a t-shirt for the summer, or a hat printed with GANAS. They are little minor things which really motivate the kids to keep on going.

Dr. Kester: Now, what does the term "Stand and Deliver" mean? You use that phrase frequently; it was even chosen as the title of the movie. But, what does it mean to you, Mr. Escalante?

Mr. Escalante: That phrase means you play defense on the test. You use all the intelligence and all the information you have stored in your brain. You prove you know math. You stand and take the test and you present it to the teacher. You deliver what you've learned. That's the meaning for me. When the kids "Stand and Deliver," they have the background, the knowledge to be able to answer any questions related to this subject.

Dr. Kester: I noticed in observing your class and in talking to you and others in the project that you do a number of unusual things. For example, you get students up to the front of the classroom, then when they are the center of attention for the whole class, you fire math questions at them. Do you have a name for that particular teaching technique?

Mr. Escalante: That's another way of showing whether you can Stand and Deliver. Now also it's to prove you're not afraid. Every time I talk to you, you have to look at me the way I look at you and answer the questions. The fans used to call Jerry West, the famous basketball player, Mr. Clutch. Why? Because when the team needed the extra point during the last seconds of the game, they'd throw the ball to him, he'd shoot and make the point. I spoke with him and he said even when he didn't have a game scheduled, he took the basketball and shot it at least 500 times. I said to the kids, I expect from you the same reflexes. If I ask a question. I expect from you the correct answer, and right away. That creates a really kind of combination in their brain. The kids expect the question, and they know they have to answer immediately. They cannot reject the ball. That builds a good framework for mathematics and thinking.

Dr. Kester: There is no place for a student to hide either, is there? If they don't do the work and learn what you expect them to learn, they risk being embarrassed in front of the whole class.

Mr. Escalante: No, they cannot, because if they don't answer the question I have to give them a second chance. That'll be a one-to-one basis after school, but with the condition that tomorrow I'll put you on the spot again. The kid says, 'go for it!' At the beginning they're afraid; at the end they like to be in front of the class and answer questions. Another thing that we do is we give values to seats. For instance, whoever reaches this chair is an A, that one is a B, the other is a C. I ask questions and whoever is seating in the first chair should know all the answers, otherwise they'll gradually go back.

Mr. Escalante: There is a challenge to be able to stay up front. One of the students asked me, "Why don't you put two As and two Bs, why only one A?' It's just to stimulate them, to motivate them to study.

Dr. Kester: Well, it has been very enjoyable for me to work with you again, Mr. Escalante. Our assignment here was to focus on the development of the "instructional manual" that, according to the grant application, was to describe your teaching and motivating methods. To save you time, my approach was first, to ask your students to identify some research-based statements that they judged to be like you, and then to use those as a prompt to you, to get you to discuss your teaching and motivating methods. This approach has provided us with information not only from you but also from your students. You have responded to the first thirty-eight items that your students say are most like you. Are there other things that have not yet been mentioned that need to be mentioned?

Mr. Escalante: One of the things I have to mention is that to have success in teaching, you have to have the administrators on your side. Besides that, you have to have commitment from the parents, because school alone cannot educate. I didn't want you to come to a conference I had with parents, because that changes the picture. The parents don't feel confident when somebody else comes to the room. The first conference we have with the parents is two weeks before the start of the new school year. These are the new unmotivated kids, so I call on the parents to get their participation, their comment to help me out. They have to sign a contract with me in order to help the students to attain success. The first day, we potluck, we only socialize: students, parents, and teachers. The second meeting is between the parents and the teacher only, no students involved. That's when I ask the parents to help me out, and I usually say I need for you to follow three steps. Number One is every time you talk to your kid, talk with love, without any limits. Number two, when you talk to your kids I want you to put in one hand discipline, and in the other one love. If you maintain the balance you'll promote responsibility.

Mr. Escalante: The last thing is more difficult for you. You must understand your teenager. If you cannot understand your teenager, you have to call me, because you and I together will help this kid to be educated, and tomorrow he is going to college. Another thing I say is, as soon as your son or daughter gets home after school, don't be dry. Ask him or her with love, "What did you do in school? How was your class, did you play games?" Try to start a conversation and build that kind of relationship with your kid, because I don't want a breakdown between the parents and the child. And another thing I ask is when your kids approach to talk to you, listen. Wake up. It's an opportunity knocking at your door to help them to be educated. The other thing is, when the kid talks to you, don't give quick answers. Don't talk about your concerns, help him/her out to be able to find their own answers and don't lie, don't ridicule. That way, you'll build an environment of happiness, love, understanding, and this way you are not just showing love for your students, you're showing what I call sensitivity toward something which belongs to you--your child. That day, the parents understand. I give one more potluck the following week and we go over again the three points and this time, a little bit more precise. With that we start building mutual support, and the kids start giving me the feedback.

Dr. Kester: Can you think of anything else that you might mention?

Mr. Escalante: I have been teaching 15 years in East Los Angeles. I find that it is good to associate with the people whose children are going to be in my classroom. There's a positive response. I also enjoy having the kids come to my house.

Dr. Kester: Yes sir. Well Mr. Escalante, I want to thank you again, it's been a real pleasure working with you over the last couple of years.

Mr. Escalante: For me it's been a great honor and so we are going to have to keep working and give a big plus for education.

Dr. Kester: Yes sir. This has been an interview with Mr. Jaime Escalante. Thank you very much for joining us.

Discussion

One ancient school of thought emphasizes a person's subjective experience. For example, John Locke (1632-1704) wrote that people can directly experience only "secondary qualities" of physical objects in the external word such as colors, sounds, tastes, odors, weights, and warmth. All we know is what our senses receive and process. Locke's position was that we cannot directly experience the "primary qualities" that are inherent in physical objects such as solidity, volume, shape, and number. Later, Bishop George Berkeley (1685-1753) agreed that the only things we, as people, can directly experience are the secondary qualities. The point is, that all we can ever "know" comes to us through our senses. What we "see," for example, is the result of light waves bouncing off an object, entering our eyes and being transformed into bioelectrical stimulation in our brain. This led Berkeley to contend—*esse est percipi* —"To be is to be perceived" (Christian, 1973, pp. 139-148). In other words, objective reality is not directly knowable.

Along the same line, it has been said that when a man and woman get married, the result is not one but at least three marriages. First, there is the single marriage recognized by the legal system. Second, there is "her marriage"—the marriage as she experiences it. And third, there is "his marriage"—the marriage as he experiences it. And, as any divorce lawyer knows, there can be enormous differences between what each spouse experiences.

In a similar way, one could say that there are several general Jaime Escalante classroom experiences. First, there is Jaime's classroom experience as one could capture on videotape. Second, there is Jaime's classroom as he experiences it. And third, there is Jaime's classroom as his students experience it. In addition, there is Jaime's classroom as experienced by observers; in this case, Angelo Villavicencio, Cathy Lum, and others, including the current writer.

Creating an Overall Conceptual Frame of Reference

Escalante's calculus students have identified thirty-eight statements as more like him (see Table 5), but this is hardly parsimonious. According to "Occam's Razor," care must be taken to discover or invent the simplest explanation. The following definition may be helpful:

> **Occam's Razor** (Also called the Principle of Parsimony). One of the fundamental principles of (the) scientific method. It states that, all else being equal, the simplest explanation is the best. That is, in developing inductive hypotheses, the simplest hypothesis which accounts for all relevant data is more likely to be true. Named after the scholastic philosopher William of Occam, who phrased it: "The number of entities should not be needlessly increased." (Christian, 1973, pp. 381, 502).

Inventing a conceptual frame of reference is risky business. There is always the possibility that it will say as much or more about the inventor than the phenomena being studied. Still, in this case, to leave the reader with Escalante's calculus students' top thirty-eight statements, even though they have passed muster by a review by Escalante, is to leave the investigation, to an important degree, unfinished. On the other hand, the following conceptual taxonomy should be considered as only one working hypothesis; only one suggested taxonomy among several that might be offered. In this taxonomy it at first appears that there are four categories into which the thirty-eight statement can be placed. These categories are:

- Personal Characteristics;
- Cognitive Restructuring;
- Teacher Expectations; and
- Mathematical Skill Development.

But, on further consideration, it will be seen that the category, "teacher expectations" may be considered to be a special case within the larger category of "cognitive restructuring." This further simplification provides us with only the following three major and one minor category. (See Table 7.) After simplifying, those categories are:

1. Personal Characteristics;
2. Cognitive Restructuring, including Teacher Expectations; and
3. Mathematical Skill Development.

An advantage of this taxonomy is that three of the four categories—"Personal Characteristics," "Teacher Expectations," and "Mathematical Skill Development"—are immediately clear and understandable. Only one—"Cognitive Restructuring"—may need to be defined and discussed at any length. In any case, three major categories are considerably more parsimonious than thirty-eight unrelated statements.

The first major category "Personal Characteristics" is self explanatory. One teacher can be more or less "funny," "enthusiastic," "energetic," "cheerful," or "friendly" than another. One may appear to be a better mathematician than another. One may "capture and hold a student's attention" better. And one may appear to "believe in his students" more.

TABLE 7

Proposed Taxonomy of Thirty-Eight Descriptive Statements Identified as More Like Jaime Escalante and His Teaching

Personal Characteristics	*Cognitive Restructuring*	*Mathematical Skill Development*
• is often funny or humorous[2] • is enthusiastic[3] • is energetic[4] • is an excellent mathematician[5] • is cheerful[6] • is friendly toward me[7] • captures and holds my attention[8] • believes in me[9]	• believes my first priority is to learn[10] • puts academics first[11] • has helped me understand that employers will want me to have a solid preparation in math, reading, writing, and problem solving[12] • has helped me see that education is important[13] • encourages me to try harder by reminding me that people beyond our school are paying attention to how well we do[14] • has helped me understand that I learn more in rigorous, tough courses than in courses that are easier[15] • has encouraged public recognition for students who succeed and promoted a sense of school pride[16]	• calls attention to diagrams, graphs, photos, or illustrations that not only relate to the lesson but also help me learn and remember[32] • has taught me rules and principles and the conditions under which they apply so I can solve math problems[33] • gives me a lot of math problems to do[34] • requires that faster learners put forth effort too; he won't let them just "coast"[35] • gives me the help I need when I get "stuck"[36] • takes us through the steps needed to solve a problem and explains the purpose of each step[37]

TABLE 7

Proposed Taxonomy of Thirty-Eight Descriptive Statements Identified as More Like Jaime Escalante and His Teaching

(Continued)

Personal Characteristics	*Cognitive Restructuring*	*Mathematical Skill Development*
	• helps me enjoy math[17] • has helped me set higher goals for myself in life[18] • helps me see myself as a "winner"[19] • has helped me understand that I can become qualified for any job I want[20] • has helped me set higher goals for myself in math[21] • has helped me become more interested in math[22] • understands the world I will face after high school[23] • helps me plan and strive for excellence[24] ***Teacher Expectations*** • expects me to work hard[25] • expects me to achieve and do well in math[26] • expects me to attend class, come to class on time, and meet the assignment deadlines[27] • expects that I can and will learn a lot of math[28]	• has helped me learn how to think through a word problem before I begin working on it: to analyze the challenges I face and explore alternative strategies before I start to work[38] • has taught me to estimate answers to math problems so that I can reject unreasonable answers and know when an answer is "in the ballpark"[39]

TABLE 7

Proposed Taxonomy of Thirty-Eight Descriptive Statements Identified as More Like Jaime Escalante and His Teaching

(Continued)

Personal Characteristics	*Cognitive Restructuring*	*Mathematical Skill Development*
	• expects me to be honest, courteous, and to show respect for others[29] • expects me to spend a lot of time on math[30] • expects and rewards my academic success[31]	

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[2] Evaluator's classroom observations notes; NEA, 1990, p. 7
[3] NEA, 1986, p. 20
[4] NEA, 1990, p. 8
[5] NEA, 1990, pp. 7, 8, 10
[6] NEA, 1986, p. 20
[7] NEA, 1986, p. 20; NEA, 1990, pp. 9, 10
[8] USDOE, 1987, p. 39; NEA, 1990, p. 8
[9] USDOE, 1987, p. 35; NEA, 1986, p. 22; NEA, 1990, p. 9
[10] USDOE, 1987, p. 58; NEA, 1990, p.8
[11] USDOE, 1987, p. 58; NEA, 1990, p. 8
[12] USDOE, 1987, p. 81
[13] USDOE, 1987, p. 15; NEA, 1990,p. 9
[14] USDOE, 1987, pp. 43, 57
[15] USDOE, 1987, p. 75; NEA, 1990, pp. 3, 4
[16] USDOE, 1987, p. 57
[17] NEA, 1990, p. 7
[18] NEA, 1990, p. 9
[19] USDOE, 1987, p. 35; NEA, 1986, p. 15; NEA, 1990, p. 9
[20] USDOE, 1987, p. 35; NEA, 1990, pp. 5, 9
[21] USDOE, 1987, p. 35; NEA, 1990, p. 9
[22] NEA, 1990, p. 7
[23] NEA, 1990, p. 9
[24] NEA, 1986, p. 18; NEA, 1990, p. 6
[25] USDOE, 1987, pp. 14, 15; NEA, 1990, p. 8
[26] USDOE, 1987, pp. 35, 58; NEA, 1986, p. 22; NEA, 1990, p. 9
[27] USDOE, 1987, pp. 35, 59; NEA, 1986, p. 22; NEA, 1990, p. 8
[28] USDOE, 1987, p. 35; NEA, 1986, p. 20; NEA, 1990, pp. 4, 9
[29] USDOE, 1987, p. 59; NEA, 1990, pp. 7, 11
[30] USDOE, 1987, pp. 15, 75
[31] USDOE, 1987, pp. 35, 58; NEA, 1986, p. 22

[32] USDOE, 1987, p. 34; NEA, 1990, p. 4
[33] USDOE, 1987, p. 38
[34] USDOE, 1987, p. 14; NEA, 1990, p. 7
[35] USDOE, 1987, pp. 14, 37, 78
[36] USDOE, 1987, p. 45; NEA, 1990, pp. 8, 9
[37] USDOE, 1987, p. 41
[38] USDOE, 1987, p. 29
[39] USDOE, 1987, P. 25

However, the boundaries around the categories should not be seen as solid. "Is an excellent mathematician" might better fit within "Mathematical Skill Development." Or perhaps this statement belongs under both categories, "Personal Characteristics" and "Mathematical Skill Development." The same could be said of the phrase, "captures and holds my attention." Similarly, "believes in me" could possibly be listed under not only "Personal Characteristics" but also "Cognitive Restructuring."

Whereas "Personal Characteristics" will vary greatly from teacher to teacher, probably nearly all teachers of high school calculus think they use most, if not all of the teaching methods listed under the third major category, "Mathematical Skill Development." Wouldn't every math teacher report that he "takes his students through the steps needed to solve a problem and explains the purpose of each step?" Wouldn't every teacher say she "helps her students learn how to think through a word problem before they start to work on it?" Wouldn't every teacher say he "gives his students the help they need when they get 'stuck'." Wouldn't every teacher say she teaches her students "rules and principles and the conditions under which they apply?"

While it may be unfamiliar to many educators, the term "Cognitive Restructuring" is currently in use by psychologists and counselors. Cognitive theories have a long history; cognition has been and still is recognized as related to human emotion.

> " . . . Aristotle . . . suggested that human beings . . . can make sensory judgments . . . of things as being good or bad for them; this estimate arouses an emotion, liking, or dislike. Thomas Aguinas . . . followed Aristotle in this explanation of emotional arousal . . .
>
> Theorists of all persuasions usually agree that anger or fear are aroused when a situation is interpreted as annoying or dangerous. Many insist that such arousal is programmed into the nervous system during evolutionary prehistory and serves biological survival. For cognitive psychologists, every emotion is aroused by knowing something and appraising it. No doubt, some appraisals are preprogrammed: infants like anything sweet the first time they taste it . . .
>
> But older children and adults appraise what they encounter not only as it affects their bodily well-being but as it affects them as persons. The child is angry when teased by buddies; the young man, when his pals show him up before his girl . . . (Corsini, 1984, pp. 242-243).

Further, Cognition is recognized as being essential in the counseling process.

> Cognitive therapies are a loosely associated group of approaches that stress the importance of cognitive processes as determinants of behavior. They maintain that behavior and emotions result largely from one's appraisal of the situation, and that, since appraisal is influenced by beliefs, assumptions, images, and self-talk, these cognitions become the targets of therapy . . . cognitive therapies differ from . . . (traditional psychotherapies) in several important respects . . . First, they stress the *primacy* of cognitions over emotions and behaviors. Since they believe cognitions instigate behaviors and trigger emotions, they maintain that the alteration of dysfunctional thoughts, assumptions, and beliefs should be the principle concern of therapy . . . In the broadest sense, most therapies are cognitive therapies, inasmuch as they seek to bring about changes in the client's private views . . . cognitive therapy differs from . . . (other) therapies in more directly attacking faulty assumptions, beliefs, and thoughts, and in specifically teaching coping skills believed to be missing from the client's repertoire (Corsini, 1984, pp. 245).

Different writers have used slightly different words to describe their approach. For example:

> Alfred Alder expressed his conviction that neurotics base their self-defeating behavior on fictional beliefs . . . therapy . . . consisted (in) . . . changing such beliefs . . . Maxwell Maltz stressed . . . proper self-programming . . . Norman Vincent Peal stressed the importance of thought control . . . Jean Piaget . . . observed that all adaptation occurred through two invariant processes: assimilation and accommodation. Accommodation is the process by which persons form concepts, called schemes, which guide behavior. Assimilation is the process of recognizing and applying existing schemas in coping with environmental demands. Not all schemas are correct guides to behavior: inadequate or erroneous schemas contribute to maladaptive behavior. Piaget's cogent writings were influential in causing . . . (many) to recognize the importance of cognitive factors.
>
> Albert Bandura . . . (helped) establish social learning theory . . . (and) stressed the importance of learning from others through imitation, and recognized the key role of such cognitions as attention, symbolization, expectancy, internality, and self-efficacy. Bandura's powerful research base . . . (helped to establish) the relationship between cognition and behavior . . . Michael Mahoney and Diane Arnkoff list Albert Ellis' rational-emotive therapy (RET), Aaron Beck's cognitive therapy, and Donald Meichenbaum's self-instructional therapy (1975) as examples of cognitive restructuring. The first two therapies attempt to restructure beliefs and assumptions, while Meichenbaum's approach attempts to change self-verbalizations (Corsini, 1984, pp. 245-246).

With this brief introduction to the theory, it may be helpful to present a couple of examples of case studies that illustrate how cognitive counseling approaches work in actual practice. Psychologists are fond of saying that that clients who are neurotic "build castles in the sky" while psychotics "live in them," meaning, of course, that psychotics are more maladjusted than are neurotics.

This first example deals with the more extremely irrational beliefs of a psychotic 14 year old boy and the cognitive intervention technologies designed to dispute and overcome those irrational beliefs.

The subject was an adolescent boy previously diagnosed as a "chronic schizophrenic" who attended a self-contained special education classroom at a regular school. Cognitive intervention included problem solving and self-instructional of erroneous client perceptions, beliefs, and self-signals. One of the boy's problems was that the other students complained that he "smelled bad." After talking with the counseling team, this area needing work was identified as his "personal hygiene and appearance."

Step one in this cognitive restructuring approach was to "identify the problem." The boy called it "teasing" and denied any awareness of body odor. In short, the boy thought he bathed as often, was as clean as other people and did not "smell bad." To dispute this, the counseling team persuaded him to make a survey of 50 people to see how frequently they bathed, washed their hair and used deodorant. The boy was surprised to learn that 47 of the 50 reported a frequency of 3.8 time per week. Having proved the boy's beliefs about his own hygiene to be incorrect, the counseling team was then able to help the boy redefine his problem as "I do not keep my body as clean as other people."

When a plan to shower frequently had been accepted but was not being followed, the team investigated. In doing so, they found an other erroneous belief. Remember the subject is psychotic; that is, schizophrenic. This time the boy confessed that he was afraid he would die if he got water on his face. Because of his extremely irrational fear, the problem was redefined with the problem-solving sequence and self-instructions shown in Table 8 (Gumaer and Headspeth, 1985, p. 378).

TABLE 8

Problem-Solving Sequence and Self-Instructions for the Fear of Washing

Problem-solving sequence	Self-instructions
Step I: I need to bathe and wash my hair, but I am afraid to get my body wet.	1. Rarely does anyone die in the shower. 2. Forty-seven people bathed every day and they are still alive.
Step II: I can shower if there is somebody nearby who can save me. I will ask Mr. ______ to stay by the door of the shower.	1. Mr. ____ is just outside. 2. Mr. ____ can give me "mouth to mouth" resuscitation.
Step III: I can shower at school with a teacher nearby until I feel more comfortable.	1. I can handle this. 2. I got my face wet and I am still alive.
Step IV: I will keep track of the compliments I get about being clean.	1. I look great. 2. I am a handsome boy.

The boy had agreed to report to his classroom 30 minutes before the first class began. While working on his fear which resulted from an irrational belief, he imagined showering while in the empty classroom. The authors reported:

> He imagined that water was hitting him in the face, and practiced the self-instructions associated with this step. This role play caused him great anxiety, but he gradually desensitized his fear as the week progressed. Mr. X, who supervised his showering (at school), reported that he talked frequently to himself, saying such key phrases as "Rarely does anyone die in the shower" and "I can handle this."
>
> After two weeks of showering at school, the boy began spontaneously showering at home. At this time, he also reported asking his father to buy deodorant and shampoo and using his brother's hair dryer. Several faculty members commented on his improved hygiene. He also began to come to school wearing more attractive and "faddish" adolescent clothing (Gumaer and Headspeth, 1985, p. 377).

From this rather extreme example of incorrect beliefs and their influence over behavior, lets turn to the next case study. This one deals with the more typical problem of inappropriate aggression of a teenage boy. Frequently, aggression toward peers in school is combined with defiant or oppositional attitudes and behaviors toward adults, but for our purposes here the focus will concern only aggression toward peers.

> The student was a 15-year old, ninth-grade male student of average intelligence . . . The student lived in a community group home for boys, having been removed from his mother's residence because of his long history of aggressive and oppositional behavior. He attended mainstream high school classes and had a C to D average in his courses at the time of referral. . . .
>
> The student's behavior at the group home has posed so serious a management problem that the director viewed the counseling referral as the last attempt at remediating the student's aggressive behavior before it became necessary to transfer him to a residential treatment facility for juvenile delinquents. (Kiselica, 1988, p. 306.)

Again, the cognitive counseling approach included metacognition, helping the boy develop his ability to think about his thoughts--as well as his actions. The counseling intervention used the more easily understood terms of "before", "during", and "after" (BDA) instead of the cognitive behavioral terms of "antecedents", "behaviors", and "consequences." The author wrote:

> One fulfilling result of working with the student on his BDA cards was observing him as he discovered, for perhaps the first time, how his interpretations of events could elicit self-defeating behaviors, how consequences could serve to strengthen those maladaptive behaviors, and how the use of alternative BDAs could elicit self-improving behaviors. (Kiselica, 1988, p. 303, 304.)

The following table shows the actions and thoughts in the "before", "during", and "after" stages. (Kiselica, 1988, p. 305, 306.)

TABLE 9

Examples of the Front and Back of a BDA Card Containing Self-Directed Questions and Answers for an Anger-Provoking Situation

Being Criticized by a Peer
(Front of Card)

Before	
1. What did someone else do before I became angry?	1. Some guy criticized me.
2. What was I thinking about before I became angry?	2. "That guy's trying to put me down . . . I'll show the chump!" "I can't let other people see me get put down. So I'll show everyone how tough I am."
During	
1. What did I do once I became angry?	1. I threatened the guy. I punched the guy in his face. I cursed and yelled at the teacher when she broke up the fight.
After	
1. What happened to me or anyone else afterward?	1. I received in-school suspension. The guy got hurt because I gave him a bloody nose.
2. How did I feel afterward?	2. I felt good at first because I proved how tough I am. Later, I felt bad because the kids at school think I am a bully.
3. What did I say to myself afterwards?	3. "I showed the chump" (immediate thought). "I wish I could stay out of trouble" (later thought).

Being Criticized by a Peer
(Back of Card)

Before	
1. What can I say to myself to keep from getting angry when criticized by a peer?	1. "It isn't worth getting upset over . . . I'll just walk away." "Maybe the guy is really trying to help me instead of trying to put me down." "I want to have a good day so I won't let this upset me."
During	
1. What can I do instead of punching someone who criticizes me?	1. Walk away. Listen to the criticism and then discuss another subject. Ignore him.
After	
1. What happened to me or anyone else afterwards?	1. I stayed out of trouble and nobody was hurt. Received praise from the group home director for having a good day.
2. How did I feel afterwards?	2. I felt good for not fighting.
3. What can I tell myself afterwards?	3. "I feel good . . . I am having a good day!" "I did it!"

All this information about cognitive psychology and counseling may be accurate, and even a little interesting, but does it relate to Jaime Escalante and what he does? The answer advanced here is a resounding "yes." Cognitive psychologists maintain that a person's cognitions, his beliefs, assumptions, and thoughts matter because they guide behavior and emotion. Clients who are having trouble coping and students who are doing poorly in school may have "faulty", "dysfunctional", "fictitious", or self-defeating beliefs, assumptions, and thoughts. It follows that one major goal of therapy or cognitive intervention is to "confront" or "attack" or "dispute" and "alter" those cognitions. Cognitive therapists work to change the client's "private views." Does Jaime do this? Does he work to change his students' private views? Does he attempt to change his students' beliefs, assumptions, and thoughts? Again the answer offered here is a resounding "yes."

Jaime doesn't just teach students to score high on ETS's advanced placement calculus test. He writes,

> "I have often said that I am trying to give my students two things, 'roots and wings . . . ' I don't merely teach math, I teach respect for American democratic values and institutions . . . I often have the class salute the American flag. I teach the kids manners if they lack them . . . with these 'roots' firmly in place, they are more likely to develop 'wings' to success, even greatness." (Escalante and Dirmann, 1990, p. 11.)

Does Jaime restructure his students' cognitions? Does he alter their beliefs about what they can do? Does he give them 'wings'?" One needs only to read a few statements listed under the heading "Cognitive Restructuring" in Table 7 to find the answers.

- He has helped me "set higher goals for myself in math" and "in life."
- He helps me "plan and strive for excellence."
- He has helped me see that "education is important," that "my first priority is to learn" and that I should "put academics first."
- He helps me see myself as a "winner."

All of these statements can be seen as part of "a picture of the world" that Jaime is deliberately presenting to his students. He writes,

> "students can learn to overcome any barrier they will ever face . . . I do not give up on my students and I expect them not to give up . . . the only thing you need for my program—and you must bring it everyday—is **ganas** (strong desire)."
>
> "If motivated properly, any student can learn mathematics . . . Often, I must persuade or cajole non-cooperative or frightened students into believing that they can do well with these subjects." (Escalante and Dirmann, 1990, pp. 3, 4, 9, 12.)

Over three years, Jaime continuously presents his views of the world and his students' potential for success. Like a good cognitive psychologist he "disputes" self-defeating attitudes, "I can't do it; it's too difficult" and alters the way his students interpret the world. "I can do it if I work hard and have the "'ganas'". "Education is important." If I try, through education, I can "become qualified for any job I want." Like a good cognitive counselor he does work to overcome false beliefs; like, "Severely disadvantaged, barrio students from the inner city cannot learn advanced math; cannot achieve academic excellence." One of his main messages is, "You can do it, Johnny." "You can do it, Maria. Just watch me, I'll show you how."

Escalante's students may not believe they will die if they get water on their faces, but they and some adults around them may hold beliefs about the students potential for success academically and later in life that are far below what Escalante believes they can achieve. A big part of what he does is change the cognitions of his students so they more nearly match his own.

Escalante's students may be able to think ahead enough to realize that the consequences will be too negative if "I punch him in the face and give him a bloody nose." But Escalante clearly works to help them think ahead and "understand that (by succeeding academically in math and other subjects) I can become qualified for any job I want."

Additional evidence exists to suggest that Escalante's students have developed an "I can do it" set of cognitions. Question number seventy-nine (#79) on the questionnaire to calculus students (Appendix C) was meant to test "attribution theory." This theory asks, to what does a student attribute his success or failure. According to this theory, the causes of a student's success or failure are either "internal", to him (due to the student's own ability and effort), or "external" to him (due to the difficulty of the task and luck). In discussing attribution, the NEA booklet entitled, Motivation: What Research Says to the Teacher put it this way.

> The research evidence in this field suggests that there are ways to increase student motivation and achievement by teacher communication and methods of instruction which help students make internal attributions (ability and effort) for success and lack-of-effort attributions for failure . . . Under these circumstances, students are less inclined to attribute success to external causes (luck, task difficulty) or to attribute failure to lack of ability (instead of lack of effort).

> If students attribute successful learning to their ability and effort, they will experience pride and reward from their performance. However, if they attribute similar results to luck or task ease, they will feel far less positive. Also, if they attribute their failure in learning to a lack of effort which is changeable for future performance, they will experience some degree of hope and feel some control in their attempts at forthcoming similar tasks. In the same vein, if students see effort as the key to success, perseverance will make a great deal more sense. But if students see failure as due to lack of ability, which is stable and much less open to modification, they will most likely experience far less hope and more feelings of incompetence and helplessness. And if students see a task as too difficult, they will not only expect failure to continue in similar situations, but the expected failure may also leave them with a chronic sense of frustration and anger . . .
>
> For teachers, this cognitive model implies that students are active participants in the learning process and the teachers' concern is not only to guide them and provide the best quality of instruction possible but also to enhance students' feelings of responsibility and personal control in the learning experience. (NEA, 1982, pp. 7, 10.)

To what do the students of Jaime Escalante attribute their success? In May 1991, forty-seven (47) of his calculus students and twenty-six (26) of his algebra 2 students chose their response to the following questionnaire prompt: "#79. My success or failure in doing a math problem correctly is due mainly to . . ." (see Appendix C.) The results are shown below in Table 10.

TABLE 10
Student Responses to the Prompt, "My Success or Failure in Doing a Math Problem Correctly is Due Mainly to . . . "

Response	Percent
a. my effort	30.1%
b. my ability	11.0%
c. my effort and ability	57.5%
d. my good luck if I get it right, my bad luck if I get it wrong	4.1%
e. the fact that the problem was either too easy, so I got it right; or too hard so I got it wrong	12.3%

According to attribution theory, students who feel in "personal control of their learning experience"; that is, successful students—like Jaime's—should attribute their success to "internal factors" such as their own effort and ability. The data reported in Table 10 support this. About eighty-four percent (83.6 percent) of Jaime's students answered:

a. "My effort," or
b. "My ability," or
c. "My effort and my ability"

This is exactly what is predicted by this cognitive theory. Students who are doing well academically should identify the cause(s) of their success as being "internal" to them (choices a, b, and c) not "external" to them (choices d and e).

"Teacher Expectations" is considered to be a special subcategory under the "Cognitive Restructuring" heading. The main point here is that teachers communicate what they expect from each student. That student in turn alters his behavior to conform more closely to his teacher's set of expectations. This self-fulfilling prophecy is sometimes also called the Pygmalion effect, after the play by George Bernard Shaw. In the movie version, Eliza Doolittle (Audrey Hepburn) explains to Colonel Pickering.

> The difference between a lady and a flower girl is the way she is treated. I shall always be a flower girl to Professor Higgins because he always treats me as a flower girl, and always will; but I know I can be a lady to you, because you treat me as a lady, and always will." (Culver Pictures)

More precisely, how do teacher expectations affect student performance? Good and Brophy have identified the following five-step process.

1. The teacher expects specific behavior and achievement from particular students.
2. Because of these expectations, the teacher behaves differently toward different students.
3. This treatment by the teacher tells each student what behavior and achievement the teacher expects from him or her and affects the student's self-concept, achievement, motivation, and level of aspiration.
4. If this teacher treatment is consistent over time, and if the student does not actively resist or change it in some way, it will shape his or her achievement and behavior. High-expectation students will be led to achieve at high levels, but the achievement of low-expectation students will decline.
5. With time, the student's achievement and behavior will conform more and more closely to what was originally expected of him or her (Slavin, 1988, p. 377).

Good and Brophy, after reviewing many studies, found research support for the following tendencies:

> . . . teachers respond more favorably to children from higher socioeconomic backgrounds, to girls, to high achievers, to compliant and cooperative children, to attractive students, to those who sit in the front and center sections of classrooms, and to those with neat handwriting and pleasant speech. They also concluded that almost all teachers seem to form expectations about pupils after just a few days of contact with them . . . (Biehler and Snowman, 1986, p. 534).

The lesson from research is that students do (to some degree) live up to the expectations that their teachers express (directly or indirectly) for them (Slavin, 1988, p. 377). Does this apply to Escalante's students? Do they perceive that he expects certain things from them? "Yes, of course" is the obvious answer. As shown in Table 7, there were seven expectations that his calculus students rated as more like him.

Does Jaime consciously use teacher expectations to guide his students? Here are Jaime's own words.

> . . . When students of any race, ethnicity, or economic status are expected to work hard they will usually rise to the occasion, devote themselves to the task, and do the work. If we expect kids to be losers they will be losers; if we expect them to be winners they will be winners. They rise, or fall, to the level of the expectations of those around them, especially their parents and their teachers . . . (Escalante and Dirmann, 1990, p. 9).

According to research done for this guide, Escalante's students are well aware that he has certain expectations of them. For example:

- He expects "me to work hard" and "to achieve and do well in math."
- He expects me to be responsible; i.e., he expects me "to attend class, come to class on time, and meet the assignment deadlines."
- He expects me to be well mannered; i.e. he expects me "to be honest, courteous, and to show respect for others."
- He expects that "I can and will learn a lot of math" and "will spend a lot of time on math".
- He "expects and rewards my academic success." (See Table 7, "Teacher Expectations.")

Escalante mentions "hard work" frequently. For example, "The key to my success with minority youngsters is a very simple time-honored tradition: hard work, and lots of it, for teacher and student alike." (Escalante and Dirmann, 1990, p. 8.) The investigation to produce this guide asked for information directly related to hard work, namely it asked students to fill in a blank to estimate the total number of hours per week they spent on homework for Mr. Escalante's class (see Appendix C, question #77). The average for seventy-three (73) respondents (47 calculus and 26 algebra 2 students) was 8.9 hours for just one class!

He expects—requires—a great deal. In addition to the "ganas" students must have, they are required to sign a contract, which among other things, commits them to spending many hours "doing math." Educational psychologists refer to this as "time on task."

> Students who enter the Escalante Math Program must sign a contract which binds them to participate in the summer programs held at ELAC, strict completion of daily homework and attendance at Saturday morning and after school study sessions. The students' parents are also required to sign the contract I sign it as well, obligating myself to bring ganas every day and to do everything possible to help the student succeed . . .
>
> One can find many of my students still working in my classroom (a converted music hall) at 4:00, 5:00, or even 6:00 p.m. each weekday and as early at 7:00 a.m. in the morning. No student with a question or a confusion [sic] is allowed to go home with it unresolved. "Come after school and see me at 3:00 p.m.," is the answer for the student who is falling behind, who did not do his or her homework, or who is having difficulty with that day's assignment (Escalante and Dirmann, 1990, p. 8).

Caveats

Every investigation in the behavioral sciences has its limitations, this is no exception. Here are a few of the more obvious ones:

Time Sample

Although the project was initially funded for three years, data from Jaime's colleagues and students were collected over about a fourteen month period. Student and colleague data were collected near the middle of the three year time frame, however and may still be representative. Ideally, data would have been collected from students repeatedly; e.g., every spring from all his Calculus A-B students.

Sample Sizes

If Escalante's students had been questioned every spring for three years, the sample size would have been 150 or more. This would have been substantial, and would have strengthened the student data.

Data from only two colleagues/key informants were included. If more could have been located and had responded, the third leg of the "data source" triangle "would have been strengthened. But it was very difficult to find colleagues of his who had actually observed him teaching for any length of time. Others were asked.

Discussions were held with a science teacher and a student worker, but neither returned the questionnaires. The science teacher admitted that he had not had the opportunity to observe Jaime for any length of time, although he had, of course, worked with him. Jaime and his project staff were protective of him and his classroom. Occasionally, someone would be granted permission to observe--say for one day, but generally, outsiders were not invited. In retrospect, this investigation was fortunate to have located two very knowledgeable informants.

Questionnaires

Two questionnaires were given, one during the pilot test to colleagues, the other to both colleagues and students. The first questionnaire was based on only one source, What Works: Research About Teaching and Learning. The second questionnaire was based on only four sources; i.e., two booklets, one journal article and the evaluator's classroom observation notes.

While a minimal number of sources formed the basis for the second questionnaire, the two booklets were written as summaries of research findings taken from numerous studies found in the research literature. No doubt exists however, that everything related to research did not become an item in the second questionnaire. That is to say, the questionnaires were finite in length and the list of items covered was not exhaustive. Something was surely left out.

In addition, since there were several sources, items taken from one source may have been very similar to items taken from another. In short, there may be overlap, so that items are not mutually exclusive.

Abbreviation

To fit the questionnaire format, research findings were condensed into short declarative statements. This shortening may have led to statements that were incomplete or even inaccurate as compared to the original findings.

Response Rates

Table 5 presents data based on responses of forty-seven (47) calculus students. The questionnaire (Appendix D) was given to students in two of Jaime's Calculus AB classes. Given a typical class size of thirty-two (32), sixty-four (64) students received questionnaires. Consequently, the response rate for the Table 5 analysis was 73 percent (47 ÷ 64). Obviously, the higher the percentage the better, but 73 percent is better than might be expected given only that almost all the respondents (95 percent) were from an ethnic minority known to be at-risk. Appendix G presents data based on responses of seventy-three (73) students from three classes taught by Jamie: two classes of Calculus AB and one class of Algebra II. Given a class size of thirty-two (32), ninety-six (96) students received questionnaires (Appendix D). Consequently, the response rate for the Appendix G analysis was 76 percent (73 ÷ 96). Again, this is quite good, especially considering the at-risk status of the project students.

Arbitrary Cutoff

Of the 75 items judged by Escalante's calculus students, 38 were said to be "more like him." This involved rank ordering the scores given to each statement. But in talking about the top 38, and cutting the list into the top and bottom half it must be remembered that the choice of the midpoint as the cutoff was entirely arbitrary. Perhaps attention should have been focused on only the top twenty statements instead of the top 38.

Apparent Accuracy and Order

In Table 5, seventy-five (75) statements about Jaime Escalante and his teaching were rank ordered. Each of those statements were placed in the order shown based on the mean (average) of scores assigned by a sample of forty-seven (47) of Jaime's calculus students. For example, the statement at the top of the list—the statement with a rank of #1—was, "Mr. Escalante is funny or humorous." The mean of this top-ranked statement was 8.362. But the appearance of three decimal place accuracy and the order derived from it need to be examined. As we shall see, the accuracy and order, while true for the sample, are only approximate for a larger population.

Calculations were carried to three decimal places to produce a rank-ordered list with a minimum of ties. Even so, there are three ties in the top 38 statements. There are two statements with rank #7, two with rank #17, and two with rank #33. When ties occurred, the means of those statements were exactly the same. For example, both statements, "Mr. Escalante is enthusiastic" and "Mr. Escalante is energetic" had means of 7.766 and both statements were ranked #7.

The next statement down the list—with a rank of #9—"Mr. Escalante expects me to attend class, come to class on time, and meet the assignment deadlines" has a mean of 7.761. This is only 0.005 below the mean of 7.766—which we have already seen is the mean of both Mr. Escalante "is energetic" and "is enthusiastic." If one's purpose is to generalize beyond the sample of 47 to all of Jaime's calculus students, the difference of 0.005 must be seen as more apparent than real. When we go beyond the sample, we must talk not about a definite point on a line; i.e., 7.761, but of an interval—a range. In this case, the mean would change from 7.761—for the sample—to a range that includes 7.761 as a midpoint.

The mean for the population would become 7.761 plus or minus a certain amount. This certain amount is due to error. In Table 5 the amount of error is shown for each statement under the column heading, "Standard Error" (the alpha level was set equal to 0.05).

Examples of surveys and interviews taken from recent headlines may be helpful. As the November 3, 1992, presidential election approached, numerous polls were conducted.

Example One: A Yankelovich/Time/CNN telephone poll of 958 registered voters asked the following question, "If the election for President were held today, for whom would you vote?" As of July 22-23, 1992, the results were, "53 percent for Clinton and 26 percent for Bush." The report included the following additional information, "Sampling error is plus (+) and minus (-) 3 percent." Thus, the percentage for Clinton—in the total population of all registered voters in America—was not exactly 53 percent (as in the sample of 958), but rather 50-56 percent. Similarly, the percentage for Bush—among all registered voters—was not 26 percent (as in the sample of 958), but rather 23-29 percent (Time, August 31, 1992, p. 14).

Example Two: Prior to Labor Day, the USA TODAY newspaper and the Cable News Network (CNN) combined to support the Gallup organization's telephone survey of 1007 registered voters. As of August 31-September 2, 1992, the results were, "54 percent for Clinton and 39 percent for Bush." The USA TODAY article included the following additional information, "Margin of error: 3 percentage points." Thus, the percentage for Clinton—in the total population of all registered voters in America—was not exactly 54 percent (as in the sample of 1007), but rather 51-57 percent. Similarly, the percentage for Bush—among all registered voters—was not 39 percent (as in the sample), but rather 36-42 percent. (USA TODAY, September 4-7, 1992, pp.1A., 8A.) It may be of interest to note that presidential survey results from Gallup over time and before Labor Day showed much less variation than those by Yankelovich. As of July 18, 1992, Gallup reported the percentages as, approximately 55 percent for Clinton and 33 percent for Bush.

In the first two examples, sample sizes were approximately 1,000; example one was based on a sample of 958, while example two was based on a sample of 1,007. For both surveys the error was 3 percent. As we shall see from the next two examples, as the size of the sample gets smaller, the size of the error gets bigger.

Example Three: For a Newsweek poll, the Gallup organization interviewed 755 registered voters by telephone, October 8-9, 1992. One of the questions asked was, "Do you think Clinton's anti-Vietnam war activities and his Soviet Union trip while he was a student at Oxford should be an important issue in the campaign?" The results were, "24 percent 'yes' and 72 percent 'no.'" This time the margin of error was given as "plus (+) and minus (-) 4 percent." (Newsweek, October 19, 1992, p. 24.) As the size of the sample dropped from about 1000 to 755, the error went up from 3 to 4 percentage points.

Example Four: For another Newsweek poll, the Gallup organization telephoned 433 registered voters after the first presidential debate on October 11, 1992. One of the questions asked was, "Which candidate had the best answers on each of the following issues?" Five issues were then listed. Here are the results for three: "Federal budget deficit: 17 percent, Bush; 25 percent, Clinton; 49 percent, Perot. Foreign policy: 60 percent, Bush; 23 percent, Clinton; 11 percent, Perot. Health care: 21 percent, Bush; 57 percent, Clinton; 14 percent, Perot." (Newsweek, October 19, 1992, p. 23.) As the sample size dropped to 433, the error increased to plus (+) and minus (-) 5 percentage points.

The point regarding the rank ordering in Table 5 is, if one wishes to generalize beyond the sample data (n=47), many of the means shown in the table would actually overlap. For the sample, the means and the order based on the means in Table 5 is exact. The greater the generalization from the sample, the greater the error. If for example, we wished to generalize from the sample of 47 to the total of 64 in Jaime's two spring Calculus AB classes the error would be relatively small. On the other hand, if we wished to generalize from the sample of 47 to all of Jaime's Calculus AB students 1989-1991, the error would be greater. In this latter case, for the population of all of Jaime's calculus students in the project from 1989-1991, the ordering in Table 5 must be seen as only approximate. This is the main reason why, in this report, we have spoken of the top thirty-eight statements as being "more like Mr. Escalante and his teaching" and the bottom thirty-eight as being "less like Mr. Escalante and his teaching." It must be noted that in the middle of the list—where an arbitrary cutoff was made—there is no doubt that there is some overlap. The column "Standard Error" in Table 5 shows how much error and how much overlap there is when one wishes to generalize to the greatest degree possible.

To illustrate how the overlap works when one generalizes the most, let us consider both the top-ranked and bottom ranked statements in Table 5. The top statement in this list, the one with the highest mean (8.362) and rank #1, actually overlaps with the next four statements down the list. This is so since the bottom of the interval for the top statement is 8.178 (8.362—.184), and this overlaps with the top of the interval for the rank #5 statement, 8.229 (7.957 + .272). The bottom of the interval for the rank #1 statement (8.178) does not overlap with the top of the rank #6 statement (8.151=7.891 + .260) since 8.151 is less than 8.178.

The bottom statement in this list, the one with the lowest mean (1.674) and rank #75, overlaps with only the one just above it, the one ranked #74. This is so since the top of the interval for the rank #75 statement (2.516 = 1.674 + .842) overlaps with the bottom of the interval for the rank #74 statement (2.306 = 2.872 - .566) but does not overlap with the rank #73 statement which has a top interval boundary of 2.599 (3.234 - .635).

Clearly, while there is overlap within the table, extremes of this list do not overlap. The bottom boundary of the rank #1 statement is 8.178 (8.362 - .184), whereas the top boundary of the rank #75 statement is 2.516 (1.674 + .842).

Again, remember that if one does not generalize beyond the 47 respondents, the figures in Table 5 are exact and there is no overlap. Further, if one generalizes only to the 64 students in Jaime's two spring '90 Calculus AB classes, the overlap would be slight. And, as we've just seen, if one generalizes as far as possible, there is overlap within the table but hot between those statements near the top and those near the bottom.

Finally, after all these cautionary statements, it should also be noted that information gathered properly by a questionnaire or survey can be quite accurate. Let's continue to use data from polls and compare the actual vote on November 4, 1992, to the results of six polls conducted through November 1, 1992 (*USA Today*, November 5, 1992, p. 6A). Remember that more than 100 million Americans actually voted.

Table 11

How the National Polls Fared

	Candidate		
Poll	Clinton	Bush	Perot
Actual vote	43%	38%	19%
The Harris Poll	44%	38%	17%
ABC News	44%	37%	16%
NBC/'Wall Street Journal'	44%	36%	15%
CBS/'New York Times'	44%	35%	15%
'Washington Post'	43%	35%	16%
USA TODAY/CNN/Gallup	49%	37%	14%

In the popular vote, Clinton actually won by five percent (5% = 43%-38%). The Harris Poll came the closest, predicting his win by six percent. All polls correctly predicted Clinton to be the winner and next president.

Omitted Item

In "Part 4: Interview with Jaime Escalante" the intent was to ask him to react to the top thirty-eight (38) statements rated by his calculus students as more like him (Table 5). He graciously did respond to all statements read to him. However, through no fault of Mr. Escalante, the interviewer mistakenly omitted the 11th ranked statement, "Mr. Escalante expects that I can and will learn a lot of math." Fortunately, this statement is somewhat similar to two other statements to which he did respond, "expects me to achieve and do well in math (rank #2)" and "gives me a lot of math problems to do (rank #20)." (See Table 5.)

Scale of Measurement

The rating scale (from -9 through +9) used by Mr. Escalante's Calculus students—and displayed in Appendix D—is assumed to be a ratio scale.

Political Ideology

Is "What Works..." a political document? At least one writer thinks it is. Gene Glass is a professor of education, Division of Leadership and Policy Studies at Arizona State University in Tempe, Arizona. In April 1987, an article of his was published in the journal, "Educational Researcher." It was entitled, "What Works: Politics and Research." (Glass, 1987.) In that article, he argued that "'What Works...' is an expression of historical American conservative political philosophy." He asserted that "conservative favorites are quoted more often or to the exclusion of liberal thinkers. One listens as Plato the moralist speaks, while Aristotle the democrat and empiricist is silent" (Glass, 1987, p.7).

Having read the first edition of "What Works..." published in January 1986, Glass noted that a number of important findings were missing. His list of omissions included:

> Open education is superior to traditional education in fostering students' adjustment, attitude toward school, creativity and independence (Giacona & Hedges, 1982, pp. 579ff, based on roughly 20 studies);
>
> Cooperative learning is superior to competitive learning (Johnson, Johnson, & Maruyama, 1983, based on 100 studies);

> Computer Assisted Instruction (CAI) benefits students. (Levin, Glass, and Meister, 1987, based on 300 studies);
>
> Children learn more in smaller classes (Glass, Cahen, Smith, & Filby, 1982, based on 77 studies) (Glass, 1987, p.7).

A reader of the Glass article might note that Glass himself had obviously done research or reviewed research in at least two of the areas he claimed should have been included in "What Works. . . ." His name as author appears twice in his list of omitted findings. (See above.) It should also be noted that Glass used the first edition of "What Works..." whereas this Instructional Guide used the second edition which included 18 more research findings.

Still, his point that the political ideology of the Reagan administration influenced the development of "What Works..." should be considered. After all, "What Works..." was created during the Reagan administration and under the supervision of Reagan's appointee, William Bennett. And, Reagan and Bennett declared themselves to be politically conservative.

Glass further asserted:

> The political goals of "What Works..."are those of the administration that produced it: To disestablish the federal bureaucracy in education, to decentralize control over education, to deregulate the practice of schooling, and to diminish financial support for schools (Glass, 1987, p.8).

Finally, Glass concluded that "What Works..." ...is *mirabile dictu*, a political document... (that it invokes research) in a modern ritual seeking legitimation of the Reagan administration's policies." "What Works..." does this and, lest one forget, previous administrations have done the same" (Glass, 1987, p.9).

A number of statements by Glass seem to ring true. For example, he states, "The findings favored by its ("What Works...") compilers are those that seem to cost nothing" (Glass, 1987, p.8). Glass could be right. Findings like: "expects me to work hard (ranked 4th)," "gives me a lot of math problems to do (ranked 20th)," "expects me to attend class, come to class on time, and meet the assignment deadlines (ranked 9th)," and "expects me to be honest, courteous, and to show respect for others (ranked 13th)" (see Table 5) do appear to call for no additional financial support from the federal government. This would be in line with Glass' assertion that politically conservative goals would include reducing financial support for schools. Apparently, Glass would say that this is why these findings were included, whereas the finding, "Children learn more in smaller classes" (Glass' list) was excluded. Reducing class size would be costly, and violate the conservative political philosophy.

But, even if Glass were 100 percent correct in his assertion that "What Works..." is highly political, it is difficult to see how that would reduce the usefulness of "What Works..." in the development of this Instructional Guide. In civil law there is a pleading called a "demurrer." After the plaintiff has formally filed his suit in which he has presented his arguments, the defendant may demur. That is, he may file a demurrer in which he assumes as true the matter as alleged by the plaintiff, and then argues that even if all of the allegations were true it would be insufficient to constitute a legal reason why the defendant should not be allowed to proceed further (Webster's New Collegiate Dictionary, 1973).

For example, let us assume—as Glass asserts—that findings about: "open education," "cooperative learning," "computer assisted instruction," and "putting students in smaller classes" should be included in "What Works... ." Even if these had been contained there, one would have to recognize that none of these apply to Jaime Escalante and his teaching. In fact, relative to class size, quite the opposite is true. Thirty-two students is certainly not "small" for a calculus class and yet Jaime had at least that many. And, there were easily twice that number (64) in his summer trig-math analysis class. Further, he did not use computer-assisted instruction or any of the other practices in the above list by Glass. In summary, the findings which Glass states should have been added would not have contributed toward the development of this Instructional Guide. Their absence had no impact.

Glass reports that secretary Bennett, in an early memo to his staff "enunciated his 'three Cs' of education: Character, content, and choice" (Glass, 1987, p.9). Glass described some members of congress as angry over how Bennett had spent discretionary research monies—"Too much concern for research on character development and vouchers..." (Glass, 1987, p.8).

A number of findings related to character development did find their way into "What Works..." and some were ranked by Escalante's calculus students as very much like him and his teaching. A partial list would probably include the following: "expects me to work hard," "gives me a lot of math problems to do," "expects me to attend class, come to class on time, and meet assignment deadlines," and "expects me to be honest, courteous, and to show respect for others." (See Table 5.)

Even if, as Glass asserts, findings like these are part of character development and therefore part of a politically conservative ideology, does that make any difference as far as the Instructional Guide is concerned? Probably not.

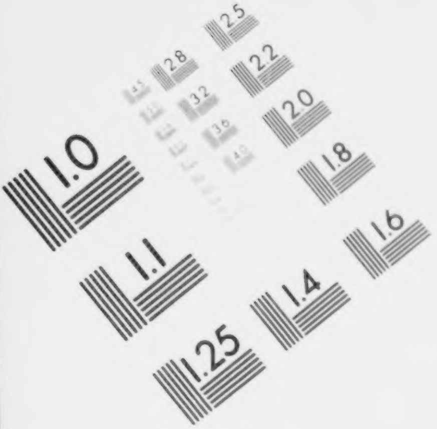
Jaime's students were given these instructions:

> Below are seventy-five statements that describe teacher characteristics and teaching techniques that research has shown to be effective. We are counting on you to tell us if you think these statements describe Mr. Escalante and his teaching techniques.... Please use the scale (-9 to +9) below to assign a rating to each of the seventy-five statements. (See Appendix D.)

It seems extremely doubtful that, as they were filling in their ratings, students took into account whether or not statements represented a politically liberal or conservative position.

In summary, the fact—if it is indeed a fact—that a statement arose from a given political position probably had no effect on the students' ratings presented in this Instructional Guide. Furthermore, the additional findings suggested by Glass simply do not apply to the tasks of this Instructional Guide; namely, to identify and describe the teaching and motivating practices of Jaime Escalante. Important findings may have been excluded, as has already been noted in this section.

Glass' contribution is that he has pointed out that a number of those missing findings may fit within a political philosophy in conflict with the Reagan/Bennett version of political conservatism.



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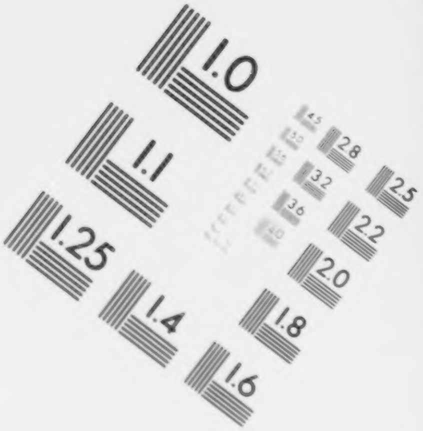

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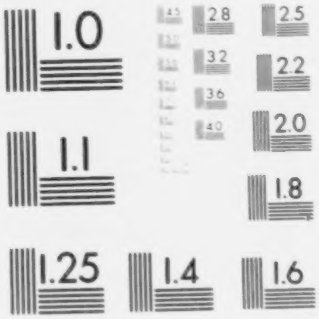
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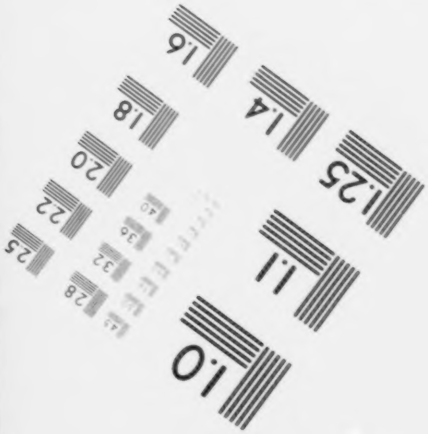

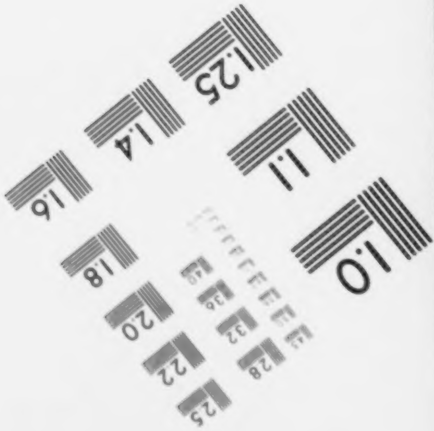

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Investigator's Point of View

While every attempt was made to be as objective as possible and present the results of questionnaires and Jaime's interview in a "They said this" and "He said that" format, the point of view of the one conducting the study and doing the writing is a factor that must be recognized. In the Discussion section of this paper, especially where an effort was made to simplify the data, the point of view of the investigator is of obvious influence. Seeing similarities between what Mr. Escalante does and "cognitive restructuring" for example, reveals the writer's interest and background as well as state credentials and licenses in counseling and psychology. Some other writer, upon seeing the same results would probably call it something else; such as "instilling a vision," or "giving them wings."

Concerns About Validity

The term validity is defined as the degree to which a test measures what it is supposed to measure (Biehler and Snowman, 186, p. 147). The question here is, "How valid, e.g., true or accurate, are the findings presented in this report?" Do the thirty-eight statements his calculus students identified as more like him truly and accurately describe him and his practices?

In the legal system, where the truth about events is in dispute, juries are impaneled to make those judgments. Here, in the absence of objective truth, both categories of participants —the teacher and the students—were questioned. In a manner unique to this study, students were asked first and the teacher later asked whether he agreed or disagreed. Throughout Part 4—the interview with Jaime Escalante—the teacher had ample opportunity to disagree with one or all of those statements. Mr. Escalante—who readily speaks his mind—clearly accepted the statements identified by his calculus students. As jury members vote on truth, here Jaime and his students voted on teacher attributes and practices. In short, Part 4 offers a validity check by the master teacher himself as to the validity or truth or accuracy of the statements identified earlier. He did add to those, but he did not delete any. (See Part 4.)

In this guide, the qualitative evaluation procedure of data triangulation was used. The three data sources were: Escalante's calculus students, Escalante's colleagues, and Escalante himself. The statement ranking done by his colleagues/key informants—the third point on the "data triangle"—produced a ranking very similar to that produced by Escalante's calculus students. In fact, of the thirty-eight statements rated by students as more like him, key informants identified twenty-eight (74 percent) of those (see Table 6).

Is there support for the notion that the statements were ranked accurately? A fourth source of information—the journal article can be consulted. Although an exhaustive analysis will not be offered here, the following may be of interest.

His calculus students put this statement at the top of their list, "Mr. Escalante is often funny or humorous." (See Table 5.) In the interview in Part 4 of this paper Mr. Escalante agreed that he intentionally uses humor as a teaching/motivating practice. Furthermore, in the journal article under "Teaching Methods, Humor" he wrote:

> I learned early in my career that teaching is fun–at least, it should be fun. Students learn better when they are having a good time. While I teach respect and discipline and I demand a great deal of hard work from my students, I always try to do it in a way that is fun. I use toys, tell lots of jokes, and let the kids participate. A teacher must enjoy his or her work and convey that joy to the students.
>
> I have found that humor carries ideas much better than a grave monotone because it makes its recipients far more willing to receive what the teacher has to say. In fact, I have heard that some students enroll in my program just because they heard it was fun, despite having little initial interest in mathematics. That does not bother me, however–usually, the interest will follow. (Escalante and Dirmann, 1990, p.7)

His calculus students certainly picked up on his intentional use of humor. Furthermore, in their essays on Escalante, both key informants mentioned his "humor" or "wit."

His students put this statement at the bottom of their list, "Mr. Escalante encourages me to get involved in extracurricular activities to round out my education." (See Table 5.) In the journal article he wrote:

> I admit that I am jealous of my students' time and the distractions which compete with my math program. I discourage them from filling their schedules with TV, sports, or other forms of "goofing off." I chide them for the headsets which pipe strains of "heavy metal" guitars into their ears when they should be working on math. I play good "defense" for my program, too. When I have to tackle aspiring athletes who want to drop calculus so that they can go to football or marching band practice, my argument is simple: In the 16 years that I have been at Garfield, not one graduate has gone on to make a living playing football, basketball, or baseball. . . From where I sit, however, I know that taking AP Calculus has a lot more to do with my students' future success than any ball or baton a student will ever pick up. (Escalante and Dirmann, 1990, p.9)

Again, his calculus students seem to have understood him perfectly. He "believes my first priority is to learn (not play sports, etc.)" and he "puts academics first." These are the second and third statements in the student's list (Table 5). It is clear that Escalante does not encourage his students to get involved in extracurricular activities. This item should be at the bottom of the list because it is very unlike him.

There are numerous other examples one could identify that show a consistency between what Mr. Escalante has written and what his students report they experience.

Conclusion

The purpose of this report was to document "... the body of techniques that make up the teaching and motivating methods of Jaime Escalante." (ELAC, 1988, p. 21.) Opinions were solicited from key informants, knowledgeable colleagues of his who had observed him for years; and his calculus students, who had taken math classes from him for three of four years. To verify the opinions of his calculus students, Mr. Escalante himself was interviewed and asked whether he used the thirty-eight practices identified by them as more like him. Knowledgeable colleagues also responded.

The insights into this exceptional teacher's practices are not presented here as conclusive or all inclusive. When this investigation was launched, no one expected Mr. Escalante to leave Garfield High School and East Los Angeles College and the Math Project to go to Sacramento where he now teaches at Hiram Johnson High School. This investigation, therefore, was meant to be developmental; that is, to be a first step toward a more complete explanation. After he left, it seemed that this report and this investigation would need to stand alone, without additional data gathering and analysis.

But fortunately, as the project moved into the last summer (1991) in which Escalante was a teacher, a videotape was made of him teaching his trig/math analysis class. Even if he never returns to teach in southern California, the project has this tape that can be analyzed in the future. This is as close as the project came to obtaining an objective record.

Now in Sacramento, Escalante is involved in producing a series of "demonstration lessons." While these lessons will no doubt prove very useful in teacher and administrator preservice and inservice training, their usefulness in research is reduced by the fact that those actions are being done for the camera to make a profit. In contrast, the videotape held by the math project was done as unobtrusively as possible during a real class (trig/math analysis) with real students. The classroom behaviors captured on tape by the project were unrehearsed and involved real students, not actors. For these and other reasons, the project tape--as the more unobtrusive and objective record--is much more prized for its future research possibilities.

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A number of outstanding evaluators are interested in the tape. At the 1990 American Evaluation Association Conference in Washington, D.C, when parts of this guide were presented, two very highly thought of researchers attended, Dr Daniel Stufflebeam and Dr. Michael Scriven. Dr. Stufflebeam is now the Director of the Center for Research on Educational Accountability and Teacher Evaluation located on the campus of Western Michigan University. Dr. Scriven is the Director of the Evaluation Institute of the Pacific Graduate School of Psychology. Both are evaluators with an international reputation. This tape may well be the last, best hope as a primary source for a series of very detailed studies on this exceptional teacher's effectiveness.

Certainly, further research should be done using the Escalante trig/math analysis tape. In addition, more detailed comparisons could be made between the journal article and the judgments made by Escalante's colleagues and his calculus students. As noted in Appendix A, Escalante's colleagues provided more information than was presented in Part 2; each wrote an essay, for example. All this deserves further attention.

For now, this paper provides the multiple perspectives of key informants, Escalante's calculus students, and Escalante himself. These perspectives have, for the most part, been related to research findings that describe effective practices. Surely, who Mr. Escalante is and what he does is much too important to be seen from one perspective only.

Fortunately for the students at Garfield and Roosevelt High Schools, the agencies that funded the original Escalante Math Project for three years, 1989-1991, have seen fit to continue their support.

Possible Replication of the Program

It would be nice if America had an army of at least a thousand Jaime Escalantes who could go into barrio high schools all over America, reverse the high dropout rate and lead those inner city high school students to academic excellence. But, of course, the truth is, we don't have a thousand Jaimes; and given the fact that he is 61 years old, America may not have him as a full-time math teacher for very much longer.

Several questions arise. Can the original Escalante Math Project based at East Los Angeles College continue to be successful without him? Could the program be repeated elsewhere? Jaime has given his answer:

> I have described the elements of my program. I believe that they can be duplicated elsewhere with ease. The key for the teacher as well as for the student is hard work. Hard work makes the future. When hard work is combined with love, humor, and a recognition of the *ganas*—the desire to learn, the ability to sacrifice, the wish to get ahead—that burns in our young people, the stereotypes and the barriers begin to crumble . . . I always have to laugh when someone suggests that my program is dependent upon one teacher's personality (my own) and could never serve as a model for use in other schools. It just shows how far away we have drifted from the fundamentals of teaching (Escalante and Dirman, 1990, pp. 6, 14).

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Appendix A

The Jaime Escalante Math Project

Item 1

Project Description

The Jaime Escalante Math Program involves many elements that research has shown are characteristic of highly successful programs: a comprehensive well-developed plan, dedicated staff, parental involvement, community support, motivational strategies, agreed upon objectives, and coordinated support services. This program prepares inner-city underrepresented students for the Advanced Placement Test in calculus, computer science, chemistry, English, and physics. On the face of it, the Escalante strategy is quite simple. Extra practice after school and during Saturday sessions builds student confidence. Each success leads to higher goal setting and the willingness to take on extra work.

The Jaime Escalante Math Program annually provides 500 elementary, middle school and high school students with hands-on practice to supplement daily instruction. These sessions occur regularly after school, on Saturdays during the academic year and for six weeks during the summer. Students in the program are from families with a median income of less than $16,000 and an average family size of five. Ethnically students identify themselves as Hispanic: 91.7 percent while 1.1 percent are white. Most parents have not completed high school (58 percent).

The Saturday component, a four hour session, conducted at East Los Angeles College, is primarily a review of the work covered during the week with an opportunity for added practice.

During the summer, students are enrolled for an intensive six week session during which participants complete a full year of math instruction. Classes, from 8:00 a.m. to 12 noon, include Algebra 1AB, Algebra 2AB, geometry, trigonometry, and mathematical analysis. Afternoon sessions, from 1:00 p.m. to 4:00 p.m., include optional sessions in physics, computer science, and preparation for the verbal (English) portion of the Scholastic Aptitude Test. Friday is test day, generally the first two hours. The remaining two hours are used for group and individual academic and career counseling, guest lecturers from industry or university, and tutoring. College readiness and vocational interest testing is provided. Fridays often include field trips to local universities and recreational trips to local beaches and parks.

Appendix A

(continued)

College students who are interested in careers as math and science teachers are used extensively throughout the program, during class sessions, after classes and on Saturdays. A tutorial component is offered from 3:00 p.m. to 5:00 p.m., Monday through Friday at the local school campuses. The program serves students who are in pre-algebra, geometry, Algebra 1AB, 2AB, math analysis, trigonometry, and in preparation for the AP examination.

Breakfast and lunch in the college cafeteria is provided on Saturdays and throughout the summer (subsidized by the U.S. Department of Agriculture). Participants who qualify (low family income are provided 25 hours per week of paid work on campus or in the community. All work experience stipends are funded through the Department of Labor (JTPA) and go directly to the students.

Additionally, the design of this program includes a variety of intervention and preventive strategies to address the special needs of the educationally disadvantaged, at-risk students from low income communities. In summary, the instructional program involves an intensive summer program and academic year Saturday program that has the following components:

1. Summer Program - Summer Programs will include basic academic instruction and cultural enrichment activities for 500 inner city, minority students.
2. Saturday School - To support the gains made during the intensive summer program students will attend a specially designed Saturday program 29 times an academic year.
3. Afternoon Tutoring - To reinforce the day's instruction and to keep all students current, the high school and junior high school teachers are available, along with tutors, from 3:00 p.m. to 5:00 p.m. Mondays through Thursdays, fall and spring.
4. Peer Tutoring - Peer tutoring will be available during the summer programs, Saturday sessions, and afternoons, fall and spring. Successful students interested in careers as math teachers will be trained to provide peer tutoring for high school students.
5. Parental Involvement - Parental involvement is essential to student's success. This project will support a variety of strategies that have been effective in creating a climate of parental involvement.

Appendix A
(continued)

6. In-service - Extensive in-service will be provided to teachers, counselors, and parents to develop the expertise needed for a high quality, model program. Program staff will enhance their capabilities to assess student progress and adapt instruction to individual needs. New, pervasive motivational strategies will be reviewed. Parents and counselors will receive training to understand the special needs of the target population.
7. Curricular Development - This project will involve original, comprehensive, well planned, systematic, and carefully constructed curricula sensitive to the unique needs of these students. Teachers manuals, curriculum materials, and lesson guides will be developed for use by program staff.
8. Intersegmental cooperation - This program will bring together teachers, counselors, and staff from junior high schools, high schools, community colleges, and four year colleges to improve course articulation and to better address the unique needs of the target population.
9. Corporate Partnership - This project will help these students to explore the linkages between school and work. In cooperation with our corporate sponsors we will undertake mock interviews, corporate mentors, career guidance workshops, work experience options, and tours of work sites.

APPENDIX A
The Jaime Escalante Math Project
Item 2
Project Teachers and Staff

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Left to right:
Front Row: Dawn Bova, Jaime Escalante, George Madrid, and Joy Shimashi; **Second Row:** Alice Green, Kevin Galvin, Steve Aguilar, and Dallas Russell;
Third Row: Angelo Villavicencio, Alice Maldonado, Roy Martinez, and George Campos; **Back Row:** Felipe Caceres, Paul Powers, Valentin Aguilera, and Sal Quezada.

APPENDIX A
The Jaime Escalante Math Project
Item 3
Project Students

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Appendix B

Questions to Key Informants

After a meeting with Dr. Kester, key informants were given:

1) The booklet entitled "What Works: Research About Teaching and Learning,"
2) An open-ended question, and
3) A Questionnaire.

The open-ended question was:

> In your own words, based on what you know, what are some of the important factors that account for Mr. Escalante's teaching success?

The questionnaire began with a cover sheet that presented the following:

Goal: To describe the intersection of Set A and Set B ($A \cap B$).

Given: Set A = {The Successful Teaching and Motivating Practices of Mr. Jaime Escalante}

Set B = {The researched practices briefly described in the booklet entitled, "What Works..."}

Research Question: What elements; i.e., successful practices, are contained within both Set A and Set B?

The questionnaire was entitled:

> A Pilot Project to Identify Jaime Escalante's Successful Teaching Practices: Getting Started Conceptually by Using the Research Foundation in "What Works..."

The first column of the questionnaire was entitled "Research Findings" and contained all fifty-nine research findings taken from "What Works...." Other column headings contained questions to be answered.

Column #1 – Research Findings

Appendix B
(continued)

Column #2 – Judgment Call

Question:

Does this research finding to some extent explain the teaching success of Jaime Escalante? Please put a check next to the best response.

______ Yes, a great deal
______ Yes, for the most part
______ Somewhat
______ Only a little
______ No, not at all

Column #3 – Examples

Questions:

Can you think of one or more real life examples of this research finding in action in his class? What happened? What did he do, say or require from the students? How did the students respond? If you can think of examples, please write some words or phrases that at least begin to describe those examples here.

Column #4 – Meaningful Words or Phrases

Question:

Even if the research finding does not apply, there may be some meaningful words or phrases that we could later use to construct our own sentence that would describe his teaching success. Are there any such words or phrases in either the research finding itself or its comment section that we could later use in this way? If so, please write those words or phrases in this column.

Column #5 – Other

Question:

Do you have any additional ideas related to this research finding or its comments section? If so, please write those ideas here.

The key informants also completed the questionnaire shown in Appendix C.

Table C-1

The Last Tier
Twenty Eight Research Findings Identified by Key Informants As Least Helpful in Explaining The Teaching Success Of Jaime Escalante

1. Curriculum of the Home

"Parents are their children's first and most influential teachers. What parents do to help their children learn is more important to academic success than how well-off the family is" (p. 5).

2. Reading to Children

"The best way for parents to help their children become better readers is to read to them even when they are very young. Children benefit from reading aloud when they discuss stories, learn to identify letters and words, and talk about the meaning of words" (p. 7).

3. Independent Reading

"Children improve their reading ability by reading a lot. Reading achievement is directly related to the amount of reading children do in school and outside" (p. 8).

11. Teaching Writing

"The most effective way to teach writing is to teach it as a process of brainstorming, composing, revising, and editing" (p. 31).

12. Vocabulary Instruction

"Children learn vocabulary better when the words they study are related to familiar experiences and to knowledge they already possess" (p. 33).

13. Reading Aloud

"Hearing good readers read and encouraging students repeatedly to read a passage aloud helps them become good readers" (p. 36).

21. Mainstreaming

"Many children who are physically handicapped or have emotional or learning problems can be given an appropriate education in well-supported regular classes and schools" (p. 69).

22. Cultural Literacy

"Students read more fluently and with greater understanding if they have knowledge of the world and their culture, past and present. Such knowledge and understanding is called cultural literacy" (p. 71).

23. Foreign Language

"The best way to learn a foreign language in school is to start early and to study it intensively over many years" (p. 73).

Table C-1
(continued)

4. Early Writing

"Children who are encouraged to draw and scribble 'stories' at an early age will later learn to compose more easily, more effectively, and with greater confidence than children who do not have this encouragement" (p. 9).

5. Speaking and Listening

"A good foundation in speaking and listening helps children become better readers" (p. 12).

6. Television

"Excessive television viewing is associated with low academic achievement. Moderate viewing especially when supervised by parents, can help children learn" (p. 13).

14. Student Ability and Effort

"Children's understanding of the relationship between being smart and hard work changes as they grow" (p. 37).

15. Purposeful Writing

"Students become more interested in writing and the quality of their writing improves when there are significant learning goals for writing assignments and a clear sense of purpose for writing" (p. 43).

16. Libraries

"The use of libraries enhances reading skills and encourages independent learning" (p. 60).

24. School to Work Transition

"Handicapped high school students who seek them are more likely to find jobs after graduation when schools prepare them for careers and private sector businesses provide on-the-job training" (p. 76).

25. History

"Skimpy requirements and declining enrollments in history classes are contributing to a decline in students' knowledge of the past" (p. 77).

26. Acceleration

"Advancing gifted students at a faster pace results in their achieving more than similarly gifted students who are taught at a normal rate" (p.78).

Table C-1
(continued)

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7. Getting Parents Involved

"Parental involvement helps children learn more effectively. Teachers who are successful at involving parents in their children's schoolwork are successful because they work at it" (p. 17).

8. Phonics

"Children get a better start in reading if they are taught phonics. Learning phonics helps them to understand the relationship between letters and sounds and to 'break the code' that links the words they hear with the words they see in print" (p. 19).

9. Reading Comprehension

"Children get more out of a reading assignment when the teacher precedes the lesson with background information and follows it with discussion" (p. 20).

17. Succeeding In a New School

"When schools provide comprehensive orientation programs for students transferring from one school to another, they ease the special stresses and adjustment difficulties those students face. The result is apt to be improved student performance" (p. 65).

18. Instructional Support

Underachieving or mildly handicapped students can benefit most from remedial education when the lessons in those classes are closely coordinated with those in their regular classes" (p. 66).

19. Collegiality

"Students benefit academically when their teachers share ideas, cooperate in activities, and assist one another's intellectual growth" (p. 67).

27. Extracurricular Activities

"High school students who complement their academic studies with extracurricular activities gain experience that contributes to their success in college" (p. 79).

28. Work Experience

"When students work more than 15 to 20 hours per week, their grades may suffer. They can benefit, however, from limited out-of-school work" (p. 80).

Table C-1
(continued)

10. Storytelling "Telling young children stories can motivate them to read. Storytelling also introduces them to cultural values and literary traditions before they can read, write, and talk about stories by themselves" (p. 23).	20. Teacher Supervision "Teachers welcome professional suggestions about improving their work, but they rarely receive them" (p. 68).

Note: All research findings were taken from What Works. Research on Teaching and Learning. Second Edition, published by the United States Department of Education, 1987. Page numbers in parenthesis refer to this publication.

Appendix D

Questionnaire to Escalante's Calculus Students
The Escalante Mathematics, Science & Computer Science Project

Name________________________________ Sex: Male_____ Female______

Address_____________________________ City_______________ Zip_________

Date of Birth_____/_____/_____ Social Sec. No._______-_______-________

The name of the class I'm taking that Mr. Escalante teaches is_________________________

This class meets during period #________________

<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<>>>>>>>>>>>>>>>>>>>>>>>>>>>>>

Instructions

As you know, Mr. Escalante's success in helping students learn math has brought well deserved national attention to his students, to him, and to Garfield High School. When you answer the following questions, you will be helping us better understand why you, his students, are consistently successful in math and why he is an exceptional teacher. Your cooperation is voluntary, and answering each question is at your option. We want you to know that the individual information you provide will be held in the strictest confidence and will be used in aggregated form for research purposes only. Thank you very much for your cooperation.

Below are seventy-five statements that describe teacher characteristics and teaching techniques that research has shown to be effective. We are counting on you to tell us if you think these statements describe Mr. Escalante and his teaching techniques. To the left of each statement is a short blank line and all of the seventy-five short blank lines are in the left column under the heading called "Rating." Please first read each statement. For example, statement #1 says that Mr. Escalante "is well organized." Next, decide if you agree or disagree with the statement. For example, do you agree or disagree that he "is well organized?" If you agree, you will assign a rating of between +1 and +9, depending on how strongly you agree. If you disagree, you will assign a rating of between -1 and -9, depending on how strongly you disagree. Please refer to the statement rating scale below when choosing the best rating number. Please notice a rating of zero (0) means you are "Undecided" or "Neutral" while positive numbers between +1 and +9 indicate increasing degrees of agreement and negative numbers between -1 and -9 indicate various degrees of disagreement with the statement. For example, if you only slightly "agree" with a statement, you would assign a "+1" rating to it. If you "very strongly agree," you would assign a "+9" rating to it. Please use the scale below to assign a rating to each of the seventy-five statements.

Appendix D
(Continued)

Statement Rating Scale

Very Strongly Disagree				Strongly Disagree			Disagree		Neutral or Undecided		Agree			Strongly Agree				Very Strongly Agree
-9	-8	-7	-6	-5	-4	-3	-2	-1	0	1	2	3	4	5	6	7	8	9

Rating **Statement to be rated**

Mr. Escalante:

____ 1) is well organized
____ 2) presents math lessons clearly
____ 3) is enthusiastic
____ 4) is energetic
____ 5) is "warm" emotionally toward me
____ 6) is friendly toward me
____ 7) expects me to achieve and do well in math
____ 8) is considerate of me
____ 9) is cheerful
____ 10) is often funny or humorous
____ 11) is an excellent mathematician
____ 12) believes in me
____ 13) helps me see myself as a "winner"
____ 14) expects me to work hard
____ 15) helps me plan and strive for excellence
____ 16) gives me the help I need when I get "stuck"
____ 17) gives me a lot of math problems to do
____ 18) helps me enjoy math
____ 19) has helped me become more interested in math
____ 20) has helped me set higher goals for myself in math
____ 21) has helped me set higher goals for myself in life
____ 22) expects me to spend a lot of time on math
____ 23) gives me math problems I can do if I paid attention during his lectures and did the assignments
____ 24) has helped me plan further into the future than I ever have before
____ 25) has helped me understand that I can become qualified for any job I want
____ 26) has helped me learn how to work hard and take responsibility for myself
____ 27) has helped me see that education is important
____ 28) manages our in-class time efficiently so that disruptions and wasted time are kept to a minimum
____ 29) has helped me understand that I as a learner need to be active not passive
____ 30) has helped me see that I can control my own destiny

Appendix D
(continued)

____ 31) understands what my life at home is like
____ 32) understands the world I will face after high school
____ 33) has tried to get my parents to become involved and supportive of my school work
____ 34) refers back to my prior knowledge when introducing new concepts
____ 35) lets me know quickly whether I did a math problem correctly or not
____ 36) lets me know quickly why I got a math problem wrong and what I should have done and why
____ 37) has taught me to estimate answers to math problems so that I can reject unreasonable answers and know when an answer is "in the ballpark"
____ 38) has helped me learn how to think through a word problem before I begin working on it; to analyze the challenges I face and explore alternative strategies before I start to work
____ 39) has guided me through the thinking processes I need to understand in order to work word problems correctly
____ 40) has given me frequent practice in doing word problems
____ 41) refers back to experiences I have already had when he introduces new concepts
____ 42) calls attention to diagrams, graphs, photos or illustrations that not only relate to the lesson but also help me learn and remember
____ 43) expects that I can and will learn a lot of math
____ 44) rewards slower learners for their progress and effort
____ 45) requires that faster learners put forth effort too; he won't let them just "coast"
____ 46) has taught me rules and principles and the conditions under which they apply so I can solve math problems
____ 47) captures and holds my attention
____ 48) sequences what we cover in class so that my knowledge builds on itself and I am ready for the next step
____ 49) monitors each student's progress so that all of us are actively engaged in learning no matter how fast we learn
____ 50) manages classroom time well by keeping wasted time and misbehavior to a minimum
____ 51) works personally with students to help them cope with especially difficult life situations
____ 52) takes us through the steps needed to solve a problem and explains the purpose of each step
____ 53) encourages me to try harder by reminding me that people beyond our school are paying attention to how well we do
____ 54) praises successful aspects of my work and gives me detailed recommendations for how I can improve
____ 55) provides me access to a math tutor whose assistance has helped me
____ 56) has helped me memorize math facts by teaching highly structured and carefully sequenced lessons with feedback from him when I get correct answers
____ 57) has helped me achieve more by asking both factual and more complex, thought-provoking questions
____ 58) has helped me develop better study skills
____ 59) gives me homework that is useful, is an important part of classroom instruction, is evaluated by him and counts toward my grade
____ 60) monitors my progress frequently and systematically
____ 61) helps me see how new information relates to old information we have already covered

Appendix D
(continued)

____ 62) has encouraged public recognition for students who succeed and promoted a sense of school pride

____ 63) has promoted agreement by the principal, teachers, students, and parents on the goals, methods, subjects and topics to be taught

____ 64) puts academics first

____ 65) believes my first priority is to learn

____ 66) expects and rewards my academic success

____ 67) expects me to be honest, courteous, and to show respect for others

____ 68) expects me to attend class, come to class on time, and meet the assignment deadlines

____ 69) enforces discipline policies consistently and fairly

____ 70) works with other math teachers at Garfield High to develop math related goals that emphasize student achievement

____ 71) has helped me understand that I learn more in rigorous, tough courses than in courses that are easier

____ 72) has helped me see the advantage of advancing in math at a faster pace by attending summer school

____ 73) encourages me to get involved in extracurricular activities to round out my education

____ 74) would much rather I not take a part-time job that would require 15 hours or more per week of my time

____ 75) has helped me understand that employers will want me to have a solid preparation in math, reading, writing, and problem solving

76) Of the 75 teacher descriptions and actions noted above, some are probably more important to you than others. Please review items 1-75 above and identify the "top ten" that are most important to you. Do this by putting a circle around the item number of each statement that you judge to be one of the "top ten" most important. For example, if you judge statement #5 above as one of your "top ten," just circle the number "5." Keep circling statement numbers until you have circled ten.

77) During the nine months you attend Garfield high, you spend about an hour each day, Monday through Friday, in Mr. Escalante's math class. Given that you spend about five hours a week on "in-class work," we want to know how many hours you spend outside of class working on "homework" for just his class. Please write your answer in the blank below. (Note: If you return to his classroom after school in the afternoon, write in the following blank the number of hours per week this is. I spend ____ hours per week working on math in the afternoon. If you also go to ELAC on Saturdays, write in the following blank the number of hours per week this is. I spend ____ hours per week working on math on Saturdays. Be sure you add your afternoon hours to your ELAC Saturday hours together with regular homework hours to get the total you write in the blank below.)

I spend an average of ____ total hours per week on homework for Mr. Escalante's class.

78) How many hours per week do you spend watching television?

I spend an average of ______hours per week watching television.

Appendix D
(continued)

79) My success or failure in doing a math problem correctly is due mainly to:

____ a) my effort
____ b) my ability
____ c) my effort and ability
____ d) my good luck if I get it right, my bad luck if I get it wrong
____ e) the fact that the problem was either too easy, so I got it right; or too hard so I got it wrong

80) Can you think of other things Mr. Escalante does or other ways to describe him that explain how he helps you? If so, please list them below. If you think one or more of these are as important as those you identified as being among your "top 10" most important, please number them as "11", "12", "13", etc. , and we will add them to your "top 10" list. If they are not that important, please just list them and identify them as "a," "b," "c," etc.

81) Is there anything else you would like to say about Mr. Escalante or what it is like to be his student? If so, you may write on the back side of this page.

Appendix E

Responses of Calculus Students to One Question on the Appendix C Questionnaire

n = 47

76) *Of the seventy-five teacher descriptions and actions noted above, some are probably more important to you than others. Please review items 1-75 above and identify the "top 10" that are most important to you. Do this by putting a circle around the item number of each statement that you judge to be one of the "top 10" most important. For example, if you judge statement #5 above as one of your "top 10," just circle the number "5." Keep circling statement numbers until you have circled ten.*

#	Item	Number of Times Identified
21)	has helped me set higher goals for myself in life	19
27)	has helped me see that education is important	15
53)	encourages me to try harder by reminding me that people beyond our school are paying attention to how well we do	15
64)	puts academics first	15
65)	believes my first priority is to learn	16
3)	is enthusiastic	14
47)	captures and holds my attention	14
13)	helps me see myself as a "winner"	13
51)	works personally with students to help them cope with especially difficult life situations	13
10)	is often funny or humorous	12
32)	understands the world I will face after high school	12
7)	expects me to achieve and do well in math	11
14)	expects me to work hard	11
26)	has helped me learn how to work hard and take responsibility for myself	11
30)	has helped me see that I can control my own destiny	11
68)	expects me to attend class, come to class on time, and meet the assignment deadlines	11
75)	has helped me understand that employers will want me to have a solid preparation in math, reading, writing, and problem solving	11
4)	is energetic	10
11)	is an excellent mathematician	10
2)	presents math lessons clearly	9
12)	believes in me	9
25)	has helped me understand that I can become qualified for any job I want	9
1)	is well organized	8
15)	helps me plan and strive for excellence	8
16)	gives me the help I need when I get "stuck"	8
20)	has helped me set higher goals for myself in math	8
24)	has helped me plan further into the future than I ever have before	8
42)	calls attention to diagrams, graphs, photos or illustrations that not only relate to the lesson but also help me learn and remember	8
71)	has helped me understand that I learn more in rigorous, tough courses than in courses that are easier	8
72)	has helped me see the advantage of advancing in math at a faster pace by attending summer school	8
8)	is considerate of me	7
36)	lets me know quickly why I got a math problem wrong and what I should have done and why	7
43)	expects that I can and will learn a lot of math	7
46)	has taught me rules and principles and the conditions under which they apply so I can solve math problems	7
49)	monitors each student's progress so that all of us are actively engaged in learning no-matter how fast we learn	7
62)	has encouraged public recognition for students who succeed and promoted a sense of school pride	7

Appendix E
(continued)

#	Item	Number of Times Identified
66)	expects and rewards my academic success	7
5)	is "warm" emotionally toward me	6
22)	expects me to spend a lot of time on math	6
31)	understands what my life at home is like	6
38)	has helped me learn how to think through a word problem before I begin working on it; to analyze the challenges I face and explore alternative strategies before I start to work	6
59)	gives me homework that is useful, is an important part of classroom instruction, is evaluated by him and counts toward my grade	6
6)	is friendly toward me	5
18)	helps me enjoy math	5
19)	has helped me become more interested in math	5
23)	gives me math problems I can do if I paid attention during his lectures and did the assignments	5
29)	has helped me understand that I as a learner need to be active not passive	5
67)	expects me to be honest, courteous, and to show respect for others	5
9)	is cheerful	4
37)	has taught me to estimate answers to math problems so that I can reject unreasonable answers and know when an answer is "in the ballpark"	4
40)	has given me frequent practice in doing word problems	4
45)	requires that faster learners put forth effort too; he won't let them just "coast"	4
52)	takes us through the steps needed to solve a problem and explains the purpose of each step	4
57)	has helped me achieve more by asking both factual and more complex, thought-provoking questions	4
17)	gives me a lot of math problems to do	3
28)	manages our in-class time efficiently so that disruptions and wasted time are kept to a minimum	3
33)	has tried to get my parents to become involved and supportive of my school work	3
35)	lets me know quickly whether I did a math problem correctly or not	3
48)	sequences what we cover in class so that my knowledge builds on itself and I am ready for the next step	3
50)	manages classroom time well by keeping wasted time and misbehavior to a minimum	3
54)	praises successful aspects of my work and gives me detailed recommendations for how I can improve	3
55)	provides me access to a math tutor whose assistance has helped me	3
73)	encourages me to get involved in extracurricular activities to round out my education	3
39)	has guided me through the thinking processes I need to understand in order to work word problems correctly	1
41)	refers back to experiences I have already had when he introduces new concepts	1
58)	has helped me develop better study skills	1
34)	refers back to my prior knowledge when introducing new concepts	2
60)	monitors my progress frequently and systematically	2
61)	helps me see how new information relates to old information we have already covered	2
63)	has promoted agreement by the principal, teachers, students, and parents on the goals, methods, subjects and topics to be taught	2
69)	enforces discipline policies consistently and fairly	2
70)	works with other math teachers at Garfield High to develop math related goals that emphasize student achievement	2
74)	would much rather I not take a part-time job that would require 15 hours or more per week of my time	2
44)	rewards slower learners for their progress and effort	0
56)	has helped me memorize math facts by teaching highly structured and carefully sequenced lessons with feedback from him when I get correct answers	0

Appendix F

Responses of Calculus Students to Two Open-Ended Questions on the Questionnaire in Appendix C
n = 47

80) Can you think of other things Mr. Escalante does or other ways to describe him that explain how he helps you? If so, please list them below. If you think one or more of these are as important as those you identified as being among your "top 10" most important, please number them as "11", "12", "13", etc. , and we will add them to your "top 10" list. If they are not that important, please just list them and identify them as "a," "b," "c," etc.

- He is very nice and encourages everyone well. He teaches us a lot of stuff that is helpful.

- a. He is creative, funny, conventional in methods of teaching.
  b. He makes us believe we can strive for excellence as long as we strive for it without quitting.
  c. Keeps a hectic schedule, yet attends to students' needs and fulfills his teaching requirements.

- 11. He encourages us, as Mexicans, to go for the best. We are as good as anyone.

- 11. Makes you feel good about yourself.
  12. Makes math interesting and challenging.
  13. Makes you see yourself as a winner.
  14. Makes you feel (believe) that you can do anything with hard work determination and "GANAS."

- a. He spends extra hours after school helping the students who need extra help.
  b. He's not only a teacher but also a friend that many students can confide in.
  c. He makes the class more interesting by letting us play games once in a while and bringing us cookies or snacks to munch on.

- 11. By pushing you further beyond the point where you quit and stopped trying.
  12. By believing in you when no one else will give you a chance.
  13. By giving examples you are capable of understanding.
  a. By never letting you quit and finding you if you do decide to quit.

- Escalante knows and understands us. A factor of his success is that he has the ability to get along with people. He's more than a teacher, he's a friend.

- a. If I don't understand it the first time, he should use another method.
  b. Thanks to him, I have seen a successful person that attended Garfield.
  c. Too bad that now he can't be in class all the school days to help or when we really need him.
  d. Mr. Escalante is very good in helping other teachers.

- 11. He will let us find out mistakes before we can go to him for help.

- He listens to my personal problems. He gives me advice. He is always there willing to help me. He is more than a math teacher.

Appendix F
(Continued)

- a. He helps us get money into our program for better education.
  b. He supports us when we need to be supported.

- 11. He spends a lot of extra time with his students in which no monetary pay is given to him.

- 11. Has taught me never to give up and try hard.
  12. Has also taught me that I can be whatever I want and that it's all up to me.
  13. Everyone can be successful.

- There are no words to express his teaching but that he is the best teacher I ever had. He inspired me to be a better student, to study more, and to believe in myself. He is the best there will ever be.

81) Is there anything else you would like to say about Mr. Escalante or what it is like to be his student? If so, you may write on the back side of this page.

- I really enjoyed being Mr. Escalante's student for the past two years and I'm looking forward to be his student again next year.

- A good and excellent teacher that Garfield should admire and thank for his efforts!

- Being a pupil of Mr. Escalante is exciting and honorable. The class is never dull; something new is always learned. The visitors and interviewers were helpful and interesting. I consider Kimo not just a teacher but a friend.

- To be Escalante's student was to be special. I don't have a father-figure at home and I'd say that. To me, Escalante was like a father to me. He is energetic and enthusiastic about education, which is good. I not only learned about calculus in his class, I learned about life as well. It was a wonderful experience being his student; one which I will never forget. I will always remember him.

- It was definitely an experience having Mr. Escalante as my teacher because I was used to having teachers that were more serious in the class. But Escalante is a very good teacher and he helps to motivate his students to strive for the best.

- He would be a better teacher if he didn't take so many trips during the year.

- He is a good teacher. His efforts to encourage students to work are great. He is a friend and a teacher.

- To be in his class you have to have the desire.

- I am honored to be a student of Mr. Escalante. Everyone has an equal opportunity to excel in his classroom, but one must be willing to sacrifice their time.

- Very proud to see a teacher so involved in teaching and should be highly commended. He is a very encouraging teacher and inspiring.

- I would like to say something that if he leaves I'll keep on calculating.

Appendix G

Responses of Calculus and Algebra II Students to Three Questions on the Questionnaire in Appendix C

n = 73

#	Item	Hours
77)	Average number of hours per week working on math in the afternoon.	5.4
	Average number of hours per week working on math on Saturdays.	2.7
	Average number of total hours per week on homework for Mr. Escalante's class.	8.9
78)	Average number of hours per week watching television.	7.7

#	Item	Percent
79)	My success or failure in doing a math problem correctly is due mainly to:	
	a) my effort	30.1%
	b) my ability	11.0%
	c) my effort and ability	57.5%
	d) my good luck if I get it right, my bad luck if I get it wrong	4.1%
	e) the fact that the problem was either too easy, so I got it right; or too hard, so I got it wrong	12.3%

Appendix H

Abstract Submitted Prior to Paper Presentations Made at Conferences Held by The American Evaluation Association and the California Educational Research Association

His recent, extraordinary success in teaching advanced calculus to inner-city mostly Hispanic students in East Los Angeles has been chronicled not only in a book, Escalante, The Best Teacher in America, but also in a film, "Stand and Deliver."

Beginning in 1989, the Escalante Mathematics Project was funded through a partnership involving grants from the National Science Foundation (NSF), ARCO, and Ford Motor Corporation, as well as in-kind support from East Los Angeles College. The project enabled "The expansion of the highly successful East Los Angeles College Advanced Placement Calculus program to include a second local high school, (and established) . . . a supporting mathematics program for three feeder junior high schools." (ELAC, 1988, p. 3)

The NSF grant application promised the production of an "Instructional Guide" that would document "the body of techniques that make up the teaching and motivating methods of Jaime Escalante." (ELAC, 1988, p.2) At the 1990 AEA Conference in Washington, D.C., and the CERA Conference in San Diego, the approach taken to generate the Instructional Guide was presented in a paper. Among other things, that approach involved asking Escalante's calculus students, who had been with him for three or four years, to complete a questionnaire in which they would rank each of 75 statements on teacher practices and attributes as more or less like him.

Those statements had been derived from research findings found in the following three sources: What Works: Research About Teaching and Learning (USDOE, 1989), Motivation: What Research Says to the Teacher (NEA, 1990). The statement judged to be most like him was, "Mr. Escalante is often funny or humorous"; the one judged to be least like him was, "Mr. Escalante encourages me to get involved in extracurricular activities to round out my education." (Kester, 1992) Two knowledgeable colleagues of Escalante, who had observed him extensively in class, completed the same questionnaire. Finally, in a videotaped interview, Escalante was asked about the top thirty-eight (38) statements from the list of those identified by his students: e.g., did he agree with or disagree with each statement, and what additional methods or practices did he use. The qualitative procedure of "data triangulation" was thus used to create the Guide, which will be available at AEA in Seattle and CERA in San Francisco.

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Appendix I
Dr. Michael Scriven's Letter

MICHAEL SCRIVEN
P.O. Box 69, Pt. Reyes, CA 94956 (415) 663-1511
"Reyes Ridge" 415 Drakes View Drive, Inverness, CA 94937
FAX: (415) 663-1913 (24 hrs.)

January 12, 1993

Don Kester
Los Angeles County Office of Education
9300 Imperial Highway
Downey, California 90242

Dear Don:

I've just had an opportunity to go through—although I didn't read every page—your very valuable evaluation report on Jaime Escalante.

I'm so glad that you were able to do this; it is a very important document in the history of the study of teaching. I hope you've made arrangements to get it into ERIC for consideration; their selection process is very weird, but I suspect you wouldn't have much trouble getting it adopted.

I haven't really heard any authoritative news about how Jaime is doing in Sacramento. This is a Saturday, so I won't be able to reach you at the office and I'm off to the East tomorrow, but if you do hear of anything, a xerox to me would be much appreciated.

All the best for the new year—and it has been a pleasure to meet you and read the report.

Sincerely,

Michael/dlc

MICHAEL SCRIVEN

MS:dlc

Appendix J
Mr. Jaime Escalante's Contract

Los Angeles Unified School District

Garfield High School

5101 E. Sixth Street, Los Angeles, California [illegible]

Telephone (213) [illegible]

LEONARD M. BRITTON

Superintendent of Schools

MARIA TOSTADO

Principal

CONTRACT FOR ADVANCED PLACEMENT CALCULUS CLASSES

As a requirement for enrolling in Mr. Escalante's Advanced Placement Calculus AB and BC, a contract must be adhered to which states:

We, the undersigned students, parents and teachers agree to abide by the following:

1. The student understands that this is a one year, college-level class. Therefore grades of C's and D's and Fail's are not acceptable.

2. Every student will bring GANAS to the class which is essential if he or she is to be successful in this class.

3. The student, through the year will build up his or her confidence in the subject and come to understand that calculus is merely a name and that the subject can be fun. Students will not be restricted in the number or questions that they can ask, even if they appear to be simple.

4. The student agrees to be on time as there is a short quiz daily at the beginning of the period. The regular test day is Friday. If a student is to be successful he or she must do the daily homework that is assigned.

5. The parents agree to cooperate with the teacher and give as much support to their son or daughter as possible by encouraging them to do 1 1/2 of hours or study every night.

6. The student agrees to come after school for help if necessary (Room MH-1) whenever he or she does not understand assignments. No excuses will be accepted as the teacher will be available every day.

7. The parents agree that their son or daughter must come Saturdays to East Los Angeles College to prepare for the SAT test, and catch up with whatever has not been completed. Breakfast and lunch will also be served.

8. The student agrees to take care of the materials, not to destroy private property, and in general help to maintain a learning environment.

9. The teacher also agrees to come to school with GANAS, and in a good frame of mind everyday. He will take the responsibility for making the course as easy as possible. He will attempt to to make each student as knowledgeable as possible about calculus so that he or she can be successful in the AP Calculus exam.

10. The teacher agrees to maintain contact with the parents and inform them of their son or daughter in the course. He will make every effort to develop the full potential of each student.

STUDENT ________________________ **DATE** ______________________

PARENTS ________________________ **DATE** ______________________

TEACHER ________________________ **DATE** ______________________

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